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REPORT OF STATIC TEST OF THE JUNKER L-6 MONOPLANE

(AIRPLANE SECTION, S. & A. BRANCH)

▽

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REPORT OF STATIC TEST OF THE JUNKER L-6 MONOPLANE.

SUMMARY OF RESULTS.

Airplane: Junker, A. S. No. 64121.
Type: L-6.
Total weight: 3,910 pounds.
Wing area: 385.6 square feet.
Engine: 6-cylinder 185 horsepower B. M. W.

Description: All-metal monoplane, capable of carrying four passengers with baggage and two pilots; has dual control arranged side by side. The JL-6 airplane compares favorably in weight and performance with the U. S. A. Type XI. All tests were based on the requirements of this type.

Date.	Part tested.	Results of test.				
		Supported factor of—	Failed at—	Factor required.	Unit weight (pounds per square foot).	Failure.
1921.						
Apr. 22	Horizontal stabilizer	6.5		5	1.17	Stabilizer and elevator did not fail.
Do	Elevator	5		5	.77	
Do	Elevator control	3	4	5		Bulkhead-supporting elevator-control walking beam failed.
Apr. 25	Vertical fin	5		4	.94	
Do	Rudder	5		4	.82	
Do	Rudder control	5	5.5	4		Left rudder-control pedal of right control failed by twisting.
	Ailerons					Ailerons and aileron controls could not be tested on account of damaged wing.
	Aileron controls					
	Wing cellule:					
June 1	High incidence	6	6.5	5.5	1.27	Both wing spars and wing spar ball joints failed.
May 27	Low incidence	3.5		3.5	1.27	
June 6	Fuselage	6.5	7.0	5.0		Engine supports collapsed and fuselage body buckled.

DISCUSSION.

The JL-6 monoplane developed sufficient strength throughout the various tests, with the exception of the control system, which is very weak. Considerable lost motion in the controls was noticed. This is due to the number of clevis pins used in the control system. Otherwise, the fuselage and surfaces are structurally satisfactory.

OBJECT.

This static test was conducted for the purpose of determining the structural strength of the JL-6 monoplane.

DATE AND PLACE.

The various component parts of the airplane were all tested at McCook Field, Dayton, Ohio, on the dates indicated below:

April 22, 1921.—Elevator and stabilizer.
April 25, 1921.—Rudder and fin.
May 27, 1921.—Wing cellule (low incidence).
June 1, 1921.—Wing cellule (high incidence).
June 6, 1921.—Fuselage.

WITNESSES (ALL TESTS).

Lieut. C. N. Monteith. Lieut. C. W. Pyle.
Lieut. E. W. Dichman. Mr. W. E. Savage.
Mr. D. B. Weaver.

SUMMARY.

The entire airplane, with the exception of the controls, developed sufficient strength in the test. Structurally the airplane is strong enough. It is a remarkable example of all-metal construction.

GENERAL RECOMMENDATIONS.

Since the control stick torque tube failed in bending at an average loading of 20 pounds per square foot, it is recommended that this tube be shortened or reinforced.

In fact, the whole control system is bad, and a complete new control system should be designed for this airplane.

GENERAL DESCRIPTION.

The JL-6 is an all-metal monoplane, the whole structure being built up of duralumin tubes, channels, angles, and corrugated sheets. The wing covering ranges from 0.012 at the tip to 0.021 inch in thickness at the root. The fuselage covering is 0.012 inch in thickness.

The whole structure is riveted together. The airplane has dual control, and the two pilots are seated side by side in the pilot's cockpit just ahead of the cabin. The cabin is arranged to accommodate four passengers comfortably, or, in other words, the airplane will carry 960 pounds of passengers and pilots.

The engine is a 6-cylinder B.M.W. of 185 horsepower.

Figures 1 and 2 are three-view drawings, showing the general design.

WING CELLULE.

DESCRIPTION.

The wing cellule is entirely of duralumin, with the exception of spar fittings and the fittings at the large ends of the spars where the ball joints are attached. These fittings are all steel.

The wing spars are tubular, each spar being built up of three different sizes of tubing telescoped at the joints, which are riveted. Figure 15 is a drawing of one spar showing the joints and the size of the tubing used. The only difference in the spars is the slight difference in length.

Figure 16 is a drawing of ball joint used in coupling the wing spars to the spars of the center section.

The internal wing bracing is of corrugated duralumin. These brace members are placed diagonally, the heavy members being used nearest the fuselage and the lighter members are used in the outer portion of the wing. All the brace members are corrugated except the bracing members of the center section, which are tubular, being reinforced on the inside and flattened at the end and riveted to the spar fittings.

Figures 11 and 12 show the method of bracing. Figure 13 shows the cross section of the corrugated braces used. Figure 54 is a photograph of the wing with half the wing cover removed.

The junker wing has nine major spars and one short tubular spar nearest the trailing edge, which is merely a stiffening member for the trailing edge.

The top and bottom wing covers are riveted together at the trailing and leading edges. A reinforcing strip is used at the leading edge, but none is used at the trailing edge.

Figure 14 shows the wing section at the junctions of the wing and the center section. Figure 9 is a wing diagram showing lateral load divisions. Figures 17 and 18 are aileron drawings showing aileron layout and sections.

No test was made of the aileron, due to the fact that the left wing was damaged to such an extent that it could only be used as a counterbalance in testing the right wing.

Figure 19 is a table of thicknesses of wing covering. Figure 20 is a table of weights and areas.

NOTE.—No reverse flight test was necessary.

PROCEDURE OF TEST (LOW INCIDENCE).

The wings were attached to the fuselage as for flight; the airplane inverted and loaded in accordance with the loading schedule in Figure 3.

The angle of inclination of the wing chord to the horizontal (angle γ) was 9° 32′ trailing edge down and was determined from the high-speed angle of incidence α and the angle β between the lift and the resultant air force.

$\alpha=-3° 20'$.

$\beta=+6° 12'$.

$\gamma=\beta-\alpha=6° 12'-(-3° 20')$.

$=9° 32'$.

The center of gravity of the load was located at 60 per cent of the chord from the leading edge, which corresponds to the position of the center of pressure of the JL-6 wing at $\alpha=-3° 20'$.

RESULTS.

Since the JL-6 tested had a damaged left wing which was repaired by wood members so as to serve as a counterbalance in the test, the results obtained are for the right wing alone.

The wing supported a load equivalent to a factor of 3.5 with no failures.

The deflections and retreat are tabulated in Figure 4 for spars Nos. 5 and 3. Figure 5 shows the deflection curves for the low incidence. Figure 56 is a picture of the low-incidence setting with a part of the load on.

PROCEDURE OF TEST (HIGH INCIDENCE).

After the low-incidence test had been completed, the airplane was reset in the inverted position for the high-incidence test. The wings were then loaded in accordance with the loading schedule in Figure 6.

The angle of inclination of the wing chord with the horizontal (γ) was 9° with the leading edge down, and was determined from the low-speed angle of incidence α and the angle β between the lift and the resultant air force.

$\alpha=16°$.

$\beta=\cot^{-1} L/D=\cot^{-1} 8.2=6° 57'$ (say, 7°).

$\gamma=\alpha-\beta=16°-7°=9°$.

The center of gravity of the load was located at 35 per cent of the chord from the leading edge, which corresponds to the position of the center of pressure of the JL-6 wing at $\alpha=+16°$.

RESULTS.

The deflections are tabulated in Figure 7. Figure 8 is a chart with curves representing the deflections of spars Nos. 4 and 2 at the various load factors. The wings were loaded to a factor of 6.5 when failure occurred.

The right wing broke off at the junction of the wing and the center section.

On examining the failure it was noted that on spars Nos. 1 and 9 the threads sheared off of the couplings.

On spars Nos. 8 and 10 the failure occurred in the center section where the tubes failed in tension.

Spar No. 7 failed in tension on the wing side of the joint.

Six of the corrugated brace members of the wing spars failed by buckling.

No wrinkling of the wing covering was noticed as the material was corrugated.

Figures 60 and 61 are pictures of the failures of the spars and joints. Figure 10 is a diagram of the spar failures.

DISCUSSION.

Subsequent examination of the failures showed that the shearing strength of the threads on the spar ball joints was equivalent to the tensile strength of the duralumin spar.

Figures 57 and 58 are pictures of the high incidence set up with the load on.

Since the left-wing load had been repaired and could be used only as a counterbalance, the load was not put on this wing in the same manner as on the wing being tested. The same loading was applied to both sides,

however, but on the repaired wing it was piled higher and along the center of the wing, which makes it appear in the picture (fig. 57) to be loaded heavier on this wing than on the other.

CONCLUSION.

The wing cell developed sufficient strength in the static test and proved to be an excellent example of all-metal construction.

STABILIZER AND ELEVATOR.

DESCRIPTION.

The stabilizer and elevator are of all-metal construction, duralumin being the material. The stabilizer is nonadjustable and the elevators are unbalanced.

Both of the elevators are built on the same spar and operated simultaneously by a mast projecting inside the fuselage and attached to the tube which forms the main spar.

Figure 22 is the stabilizer assembly showing sections.

Figures 23, 24, 25, and 26 are stabilizer detail construction drawings showing sections. Figure 27 is the elevator assembly. Figure 28 is a drawing of the details of construction of the elevator.

The total area of the stabilizer is 28 square feet, while the weight is 33 pounds, or 1.17 pounds per square foot.

The total area of the elevator is 20.8 square feet and the weight is 16 pounds, or 0.77 pound per square foot.

PROCEDURE.

The stabilizer and elevator were mounted on the fuselage as for flight. The surfaces were then loaded according to the loading schedule in Figure 21.

A spring balance was coupled in the controls to register the pull in the controls.

The deflections were taken after each additional increment of the load has been in place for a period of five minutes.

The center of gravity of the load on the elevator is located at five-twelfths of the mean chord from the hinge pin center.

RESULTS.

At an average loading of 15 pounds per square foot the control stick was seen to bend. The pull on the stick (as indicated by the spring balance) was 150 pounds.

At an average loading of 20 pounds per square foot the control stick torque tube failed in bending. This tube is the transverse tube on which both the control sticks are mounted, the JL-6 having a dual control with pilots seated side by side.

The front part of the controls were disconnected and the test continued.

At an average loading of 25 pounds per square foot the bulkhead supporting the walking beam between the first and second linkages of the elevator control failed. Both the rivets tore out and the metal tore where the failure occurred.

Figure 35 shows a sketch of the rear part of the elevator controls, which shows the forces in the control members and also the force exerted on the bulkhead which caused the failure.

A table of deflections and a loading schedule may be found in Figure 21.

The stabilizer held a loading of 32.5 pounds per square foot without failure. The test was then discontinued.

Figure 65 is a picture of the fuselage showing the elevator controls. Figure 64 is a picture of the failure of the bulkhead. Figure 34 is a drawing of the aileron and elevator control.

DISCUSSION.

The required average load per square foot for the horizontal tail surfaces is 25 pounds for an airplane of this type. Since the surfaces themselves showed no signs of failure during the test, they are structurally satisfactory. However, the controls are weak, since the failure of the control stick occurred at an average loading of 15 pounds per square foot and the failure of the torque tube occurred at an average loading of 20 pounds per square foot. The bulkhead failed at an average loading of 25 pounds per square foot.

RECOMMENDATIONS.

The control stick torque tube should be heavier or else have more support near the center of the tube.

A piece of corrugated duralumin riveted in the fuselage between the fuselage cover and the bulkhead mounting the elevator-control walking beam would strengthen the bulkhead sufficiently.

RUDDER AND FIN.

DESCRIPTION.

The rudder and fin are of all-metal construction, duralumin being used throughout.

Both rudder and fin are covered with duralumin of 0.012 inch in thickness.

The rudder is unbalanced. The weight of the rudder is 9.5 pounds. The weight of the fin is 5 pounds. The area of the rudder is 11.5 square feet. The area of the fin is 5.3 square feet. The weight per square foot of the rudder is 0.826 pound. The weight per square foot of the fin is 0.943 pound.

PROCEDURE.

The rudder and fin were mounted on the fuselage as for flight. The fuselage was then turned on its side and the surfaces loaded according to the loading schedule in Figure 29.

A spring balance was coupled in the controls to register the pull in the members.

Deflections were taken after each additional increment of the load had been in place for 5 minutes.

RESULTS.

The rudder and fin carried the load satisfactorily all through the test, but the left rudder pedal of the right control failed by twisting at an average loading of 27.5 pounds per square foot.

The test showed that the vertical tail surfaces were well constructed.

The results are tabulated in Figure 29. Figure 30 is a drawing of the rudder showing sections. Figure 31 shows detail drawings of the rudder. Figure 32 is a drawing of the fin showing sections. Figure 33 is a drawing of the rudder-control pedals.

DISCUSSION.

Since an average load of 20 pounds per square foot is the requirement for an airplane of this type and the

vertical tail surfaces withstood a loading of 27.5 pounds per square foot without failure, the surfaces are satisfactory structurally.

The rudder-control system is likewise amply strong.

RECOMMENDATIONS.

Although the rudder-control system of the JL-6 monoplane is adequate for an airplane of this type, it is recommended that a standard control system be designed for this airplane. This would eliminate lost motion in the joints.

FUSELAGE.

DESCRIPTION.

The fuselage of the JL-6 is entirely of metal construction. The engine support and entire front end is constructed of channel sections, "I" sections, and tubular members. The members are all fastened together by riveting. There are no longerons. Corrugated sheet duralumin riveted to the structure forms the fuselage covering. Nine transverse bulkheads stiffen the fuselage structure.

Figure 65 is a picture of the fuselage. Figure 45 is a drawing of the bulkhead supporting the elevator control walking beam. This bulkhead failed while the elevator was being tested.

The following figures show the fuselage bulkheads and their construction:

Figure 38.—Bulkhead No. 1.
Figure 39.—Bulkhead No. 1 details.
Figure 40.—Bulkhead No. 2.
Figure 41.—Bulkhead No. 3.
Figure 42.—Bulkhead No. 4.
Figure 43.—Bulkhead No. 5.
Figure 44.—Bulkhead No. 6.
Figure 45.—Bulkhead No. 7.
Figure 46.—Bulkhead No. 8.
Figure 47.—Bulkhead No. 9.
Figure 48.—Diagonal bulkhead (tail skid elastic support).
Figure 49.—Bulkhead No. 10.
Figure 50.—Stern post of fuselage.
Figure 51.—Fuselage bulkhead (positions).
Figure 52.—Fuselage door.
Figure 53.—Fuselage door lock.
Figure 55.—A picture of the center section of the fuselage with the lower cover removed. The method of bracing may be seen.

PROCEDURE.

The fuselage was set up (less wings and tail surfaces) for the test and loaded according to the loading schedule in Figure 36. The loads were concentrated as indicated by the letters A, B, C, D, etc., in Figure 36. The deflection readings were taken after each half factor of the load had been allowed to remain in place for a period of five minutes. These deflections may be seen in Figure 37.

RESULTS.

The fuselage withstood a load factor of 4.5 without any considerable distortion, but when a load factor of 5 was reached the rear part of the fuselage buckled along the side seams.

At a load factor of 7 the front end of the fuselage (the engine bed and supports) collapsed. The structure was then counterbalanced and the load on the rear (equivalent to the same factor 7) was allowed to settle and the rear portion collapsed. The first failure occurred before the jacks supporting the rear load had been fully released. The second failure occurred just back of the cabin.

The deflections are tabulated in Figure 37. Figure 59 is a picture of the failure of the front end of the fuselage. Figure 62 is a picture of the failure of the rear part of the fuselage. Figure 63 is a picture of the same failure with the covering removed and bulkhead No. 4 exposed.

DISCUSSION.

A fuselage for an airplane of this type is required to stand a load factor of 5. Although the JL-6 fuselage showed signs of buckling at this loading, it did not fail until a load factor of 7 was imposed. The fuselage of the JL-6 is amply strong and well designed.

RECOMMENDATIONS.

It is recommended that reinforcing strip be riveted in the fuselage around the bulkhead which carries the rear walking beam of the elevator controls. This would eliminate failure similar to the one in the elevator test.

INVESTIGATION OF JL-6 WING MEMBERS.

After checking the sizes of the wing members of the JL-6 with the sizes of the wing members of the Junker biplane (which was previously tested) it was found unnecessary to repeat the testing of these parts, since the same size members are used in both airplanes. However, a few check tests were made, the results of which are herewith tabulated.

	Duralumin tube.	Ball-and-socket joint.	
		Small tube.	Large tube.
Specimen marked	1	2A	2B
Diameter, inches	1.562	1.973	2.364
Thickness, inches	.061	.062	.059
Area, square inches	.2876	.37222	.42724
Area corrected for rivet holes	....	.34457	....
Yielding point, pounds per square inch	39,600	44,260	....
Ultimate strength pounds per square inch	52,500	53,720	....
Elongation, per cent in 2 inches	13.0	....	....
Elongation, per cent in 4 inches	12.5	....	....
Elongation, per cent in 8 inches	10.0	....	....
Location of fracture	O. T.	Tube.	None.
Character of fracture	Diagonal; jagged.	Square.	....

NOTE.—Ball-and-socket joint was O. K. Failure occurred in small tube through rivet holes.

These test results check very favorably with the physical properties of the specimens of the Junker biplane published in McCook Field Report, Serial No. 1412.

An interesting feature of the ball-and-socket wing joint is the fact that on the high-incidence static wing test some of the joints failed at the threads, while others failed on either side of the joint in the spar itself. The wing joints are very well designed.

The chemical composition of the duralumin used in the Junker airplanes is as follows:

Silicon	0.51
Copper	3.34
Iron	.81
Magnesium	.59
Manganese	.15
Aluminum	94.60

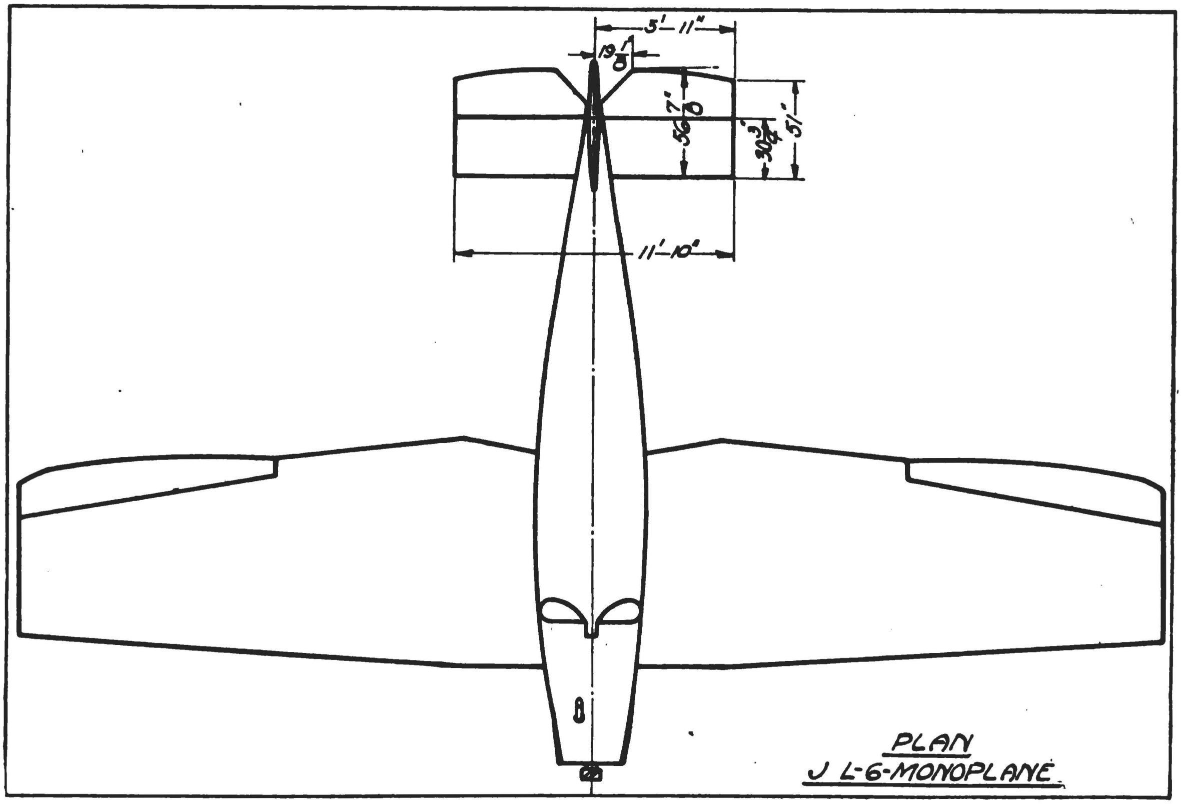

5'-11"
11'-10"
PLAN
J L-6-MONOPLANE

Fig. 1.

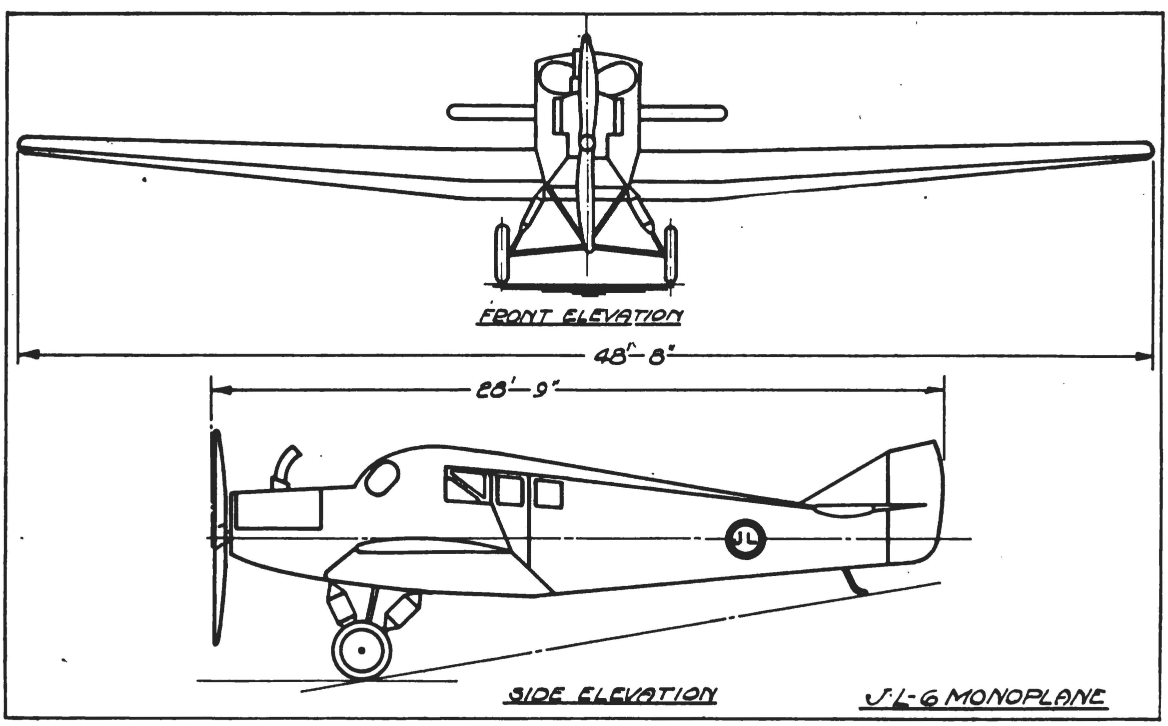
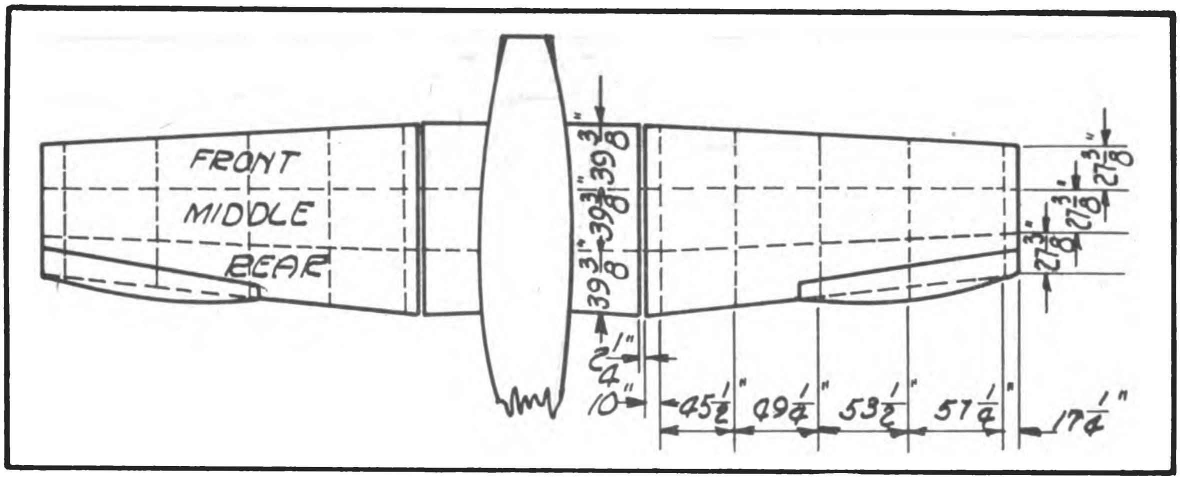

FRONT ELEVATION
48'-8"
28'-9"
SIDE ELEVATION
J-L-6 MONOPLANE

Fig 2.



LOADING SCHEDULE FOR LOW INCIDENCE ANGLE.

Load factor.	Load (in pounds) over each section of the wings.			Total load on wing.
	F	M	R	
2	580	2,890	2,310	5,780
2.5	740	3,690	2,940	7,370
3	900	4,490	3,570	8,960
3.5	1,060	5,290	4,200	10,550

Wings held and test was discontinued.

FIG. 3.—JL-6 wing.

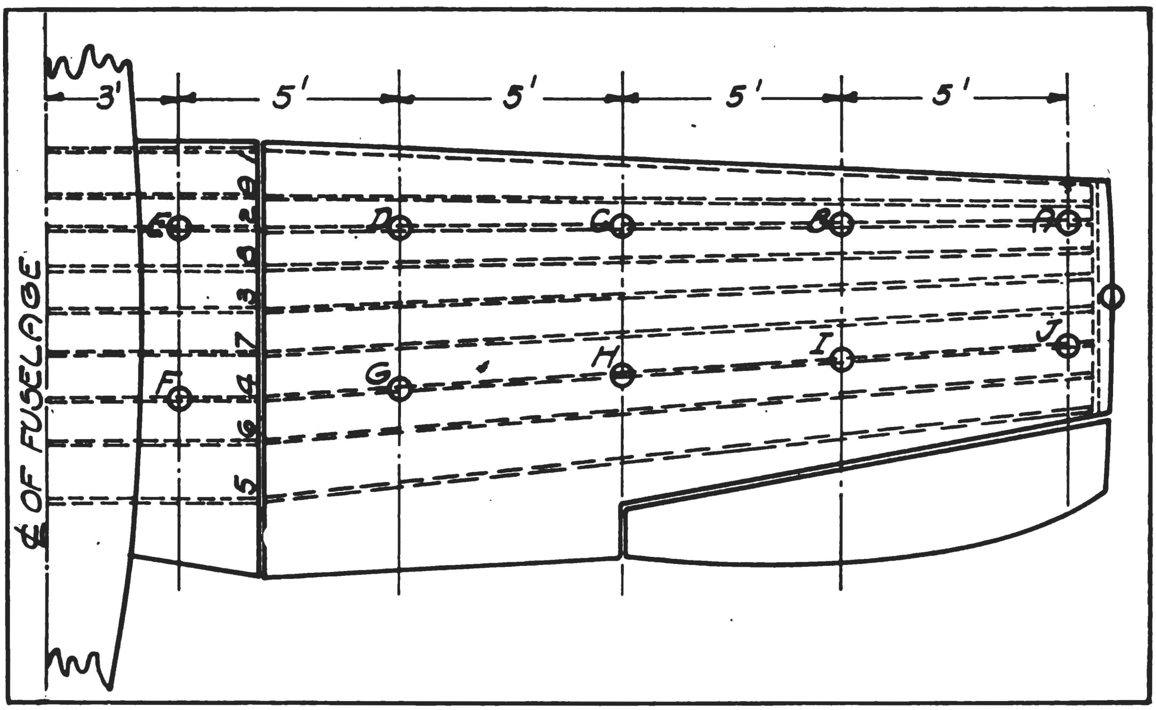


TABLE OF DEFLECTIONS OF THE RIGHT WING FOR THE LOW INCIDENCE ANGLE.

Load factor.	Deflections in inches measured at—										Retreat.
	A	B	C	D	E	F	G	H	I	J	Y
2	4.5	3.2	2.7	1.0	0.5	4.7	3.6	2.3	1.3	0.5	+0.1
2.5	5.8	3.9	2.7	2.4	.6	5.9	4.1	2.8	1.6	.6	+.2
3.0	7.1	4.9	3.2	1.7	.6	7.1	5.3	3.4	2.1	.7	+.2
3.5	8.5	6.0	3.9	2.0	.8	8.7	6.3	4.1	2.4	.9	−.1

Test discontinued.

FIG. 4.—JL-6 monoplane.

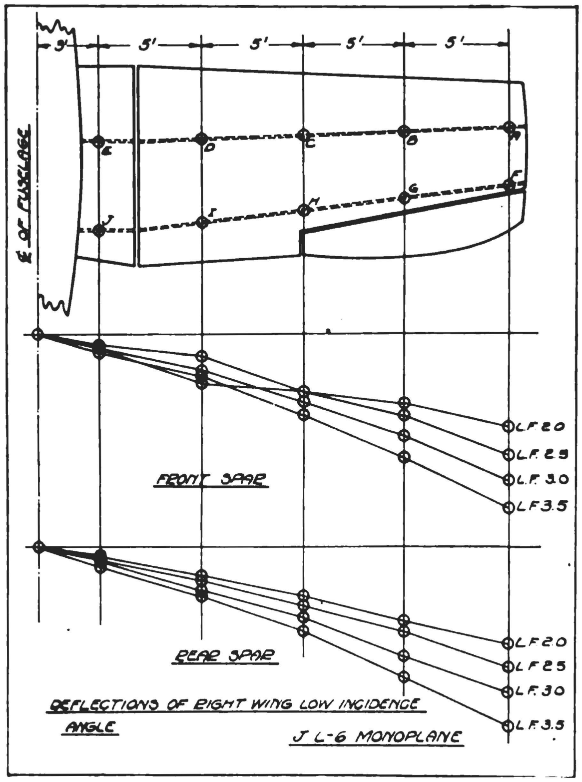
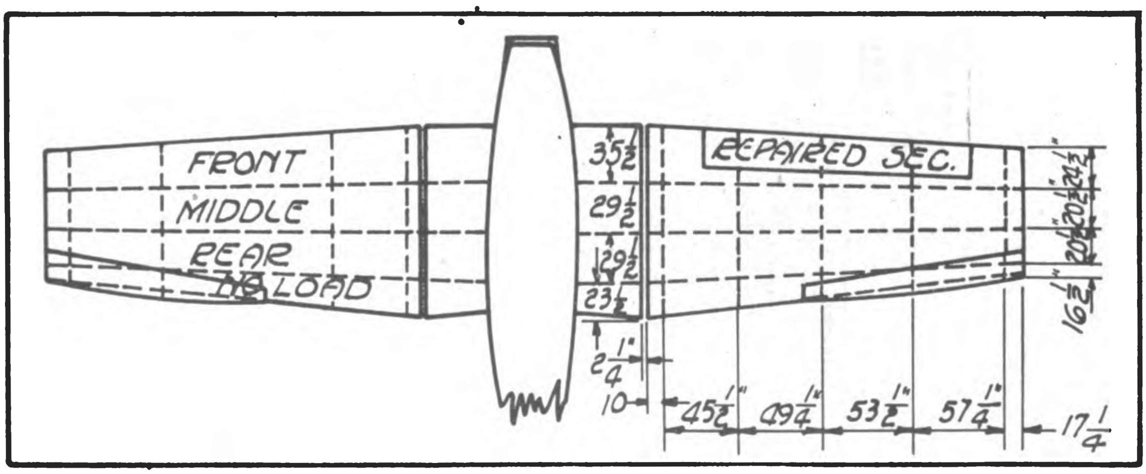


FIG. 5.



LOADING SCHEDULE FOR HIGH INCIDENCE ANGLE.

Load factor.	Load (in pounds) over each section of the wings.			Total load on wing.
	F	M	R	
2	2,890	1,450	1,440	5,780
3	4,480	2,250	2,230	8,960
3.5	5,280	2,650	2,620	10,550
4	6,080	3,050	3,010	12,140
4.5	6,880	3,450	3,400	13,730
5	7,680	3,850	3,790	15,320
5.5	8,480	4,250	4,180	17,910
6	9,280	4,650	4,570	18,500
6.5	10,080	5,050	4,960	20,090

FIG. 6.—JL-6 monoplane.

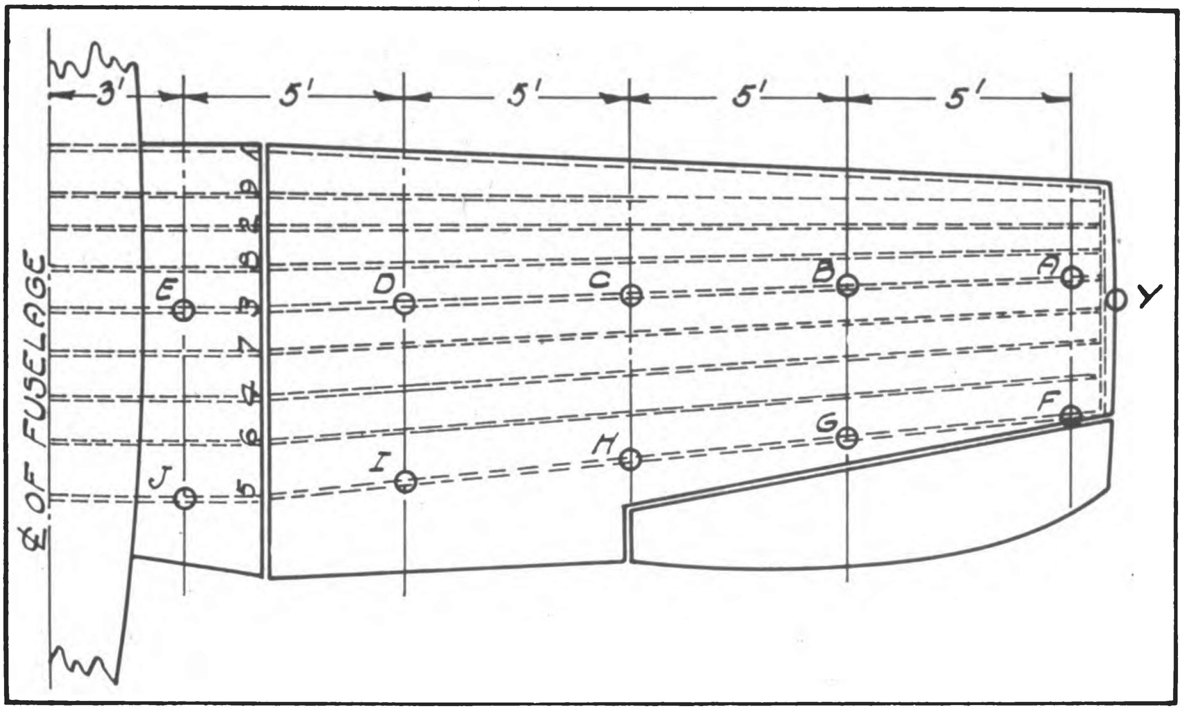


TABLE OF DEFLECTIONS OF THE RIGHT WING FOR THE HIGH INCIDENCE ANGLE.

Load factor.	Deflections, in inches, measured at—										Retreat.
	A	B	C	D	E	F	G	H	I	J	Point Y.
2	3.6	2.5	1.5	0.9	0.4	0.6	1.1	2.0	2.9	4.1	+0.8
3	5.5	3.9	2.4	1.3	.5	.8	1.7	3.1	4.5	6.4	+1.4
3.5	6.2	4.3	2.7	1.4	.5	.9	2.1	3.7	5.5	8.0	+1.1
4	7.1	4.9	3.0	1.6	.6	1.1	2.4	4.7	6.4	9.4	+1.3
4.5	8.1	5.7	3.4	1.8	.7	1.2	2.8	5.1	7.5	10.9	+1.5
5	9.6	6.6	4.0	2.0	.7	1.2	3.2	5.8	8.5	12.3	+1.3
5.5	12.7	7.6	4.6	2.3	.9	1.3	3.5	6.5	9.8	13.9	+2.0
6	Deflection readings discontinued.										
6.5	Failure.										
7	....	....	....	....	....	....	....	....	....	....	....

FIG. 7.

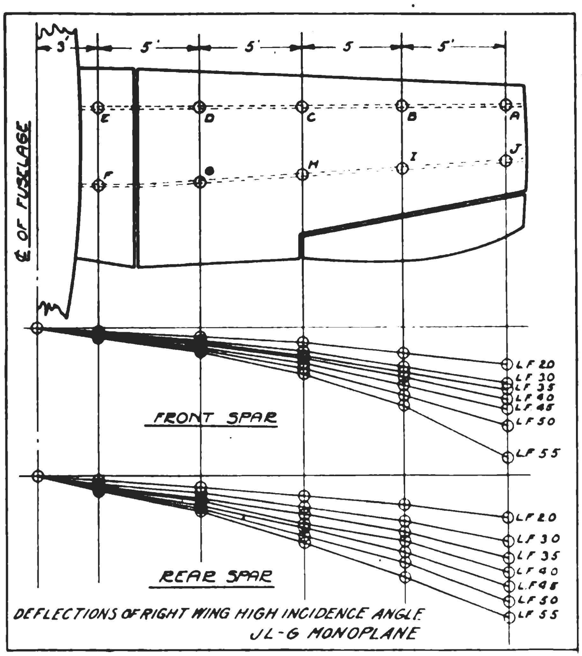


FIG. 8.

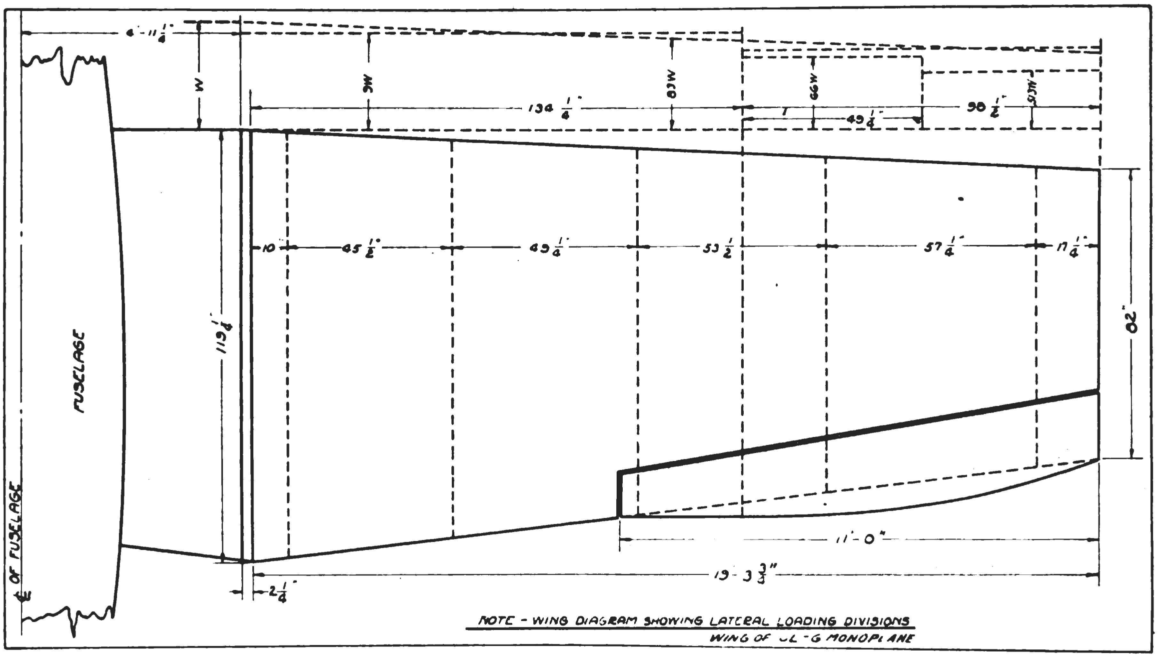
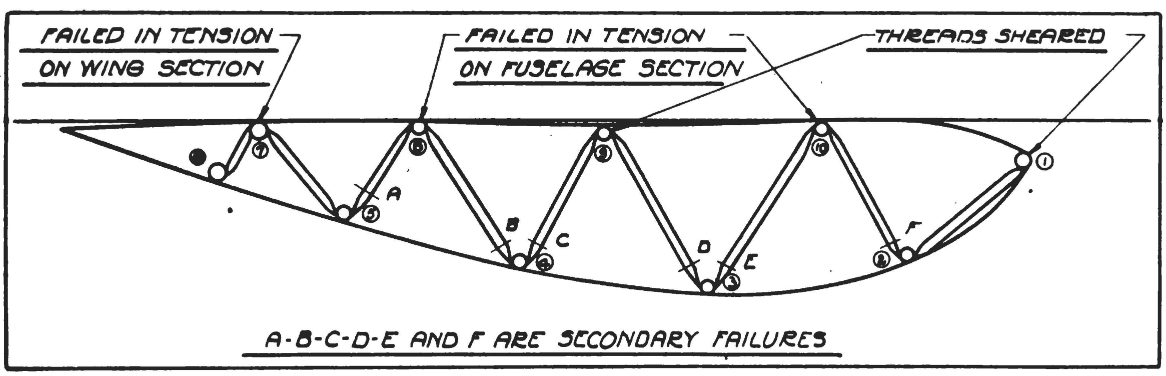


Fig. 9.



Note: Diagram of the spar failures of the right wing at the junction of center section. Sketch shows wing inverted as for test.

Fig. 10.

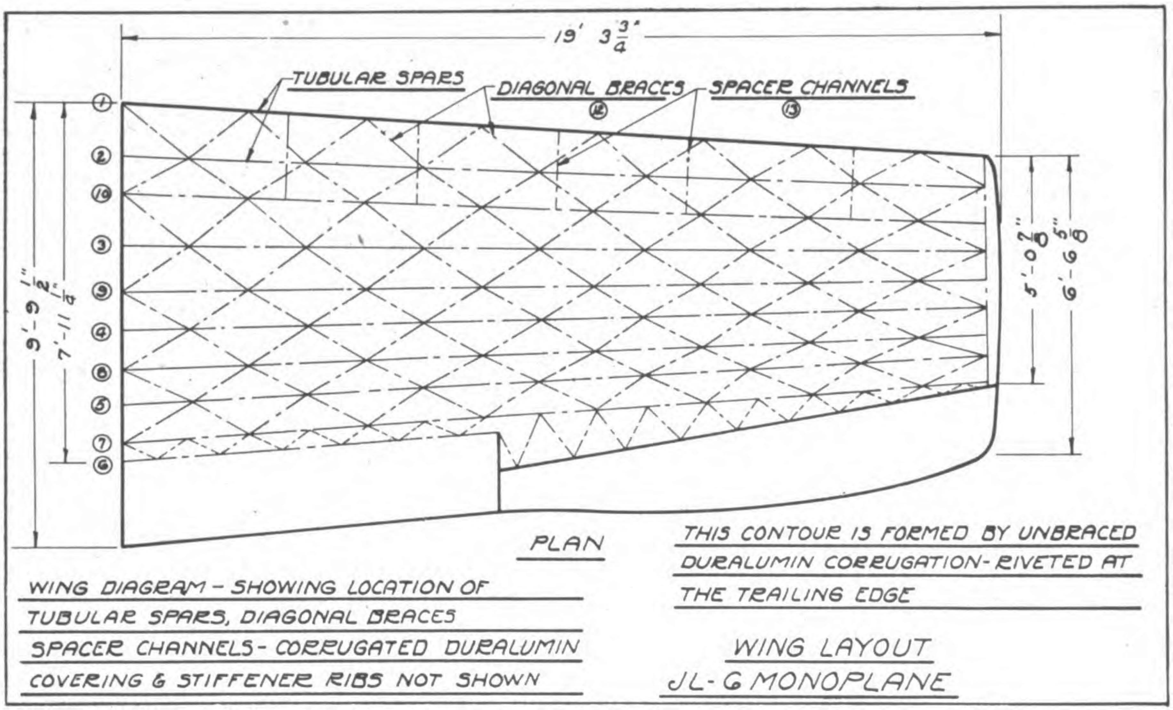

19' 3 3/4"
TUBULAR SPARS
DIAGONAL BRACES ⑫
SPACER CHANNELS ⑬
9'-9 1/2"
7'-11 1/4"
5'-0 7/8"
6'-6 5/8"
PLAN
THIS CONTOUR IS FORMED BY UNBRACED DURALUMIN CORRUGATION - RIVETED AT THE TRAILING EDGE
WING DIAGRAM - SHOWING LOCATION OF TUBULAR SPARS, DIAGONAL BRACES SPACER CHANNELS - CORRUGATED DURALUMIN COVERING & STIFFENER RIBS NOT SHOWN
WING LAYOUT
JL-6 MONOPLANE

Fig. 11.

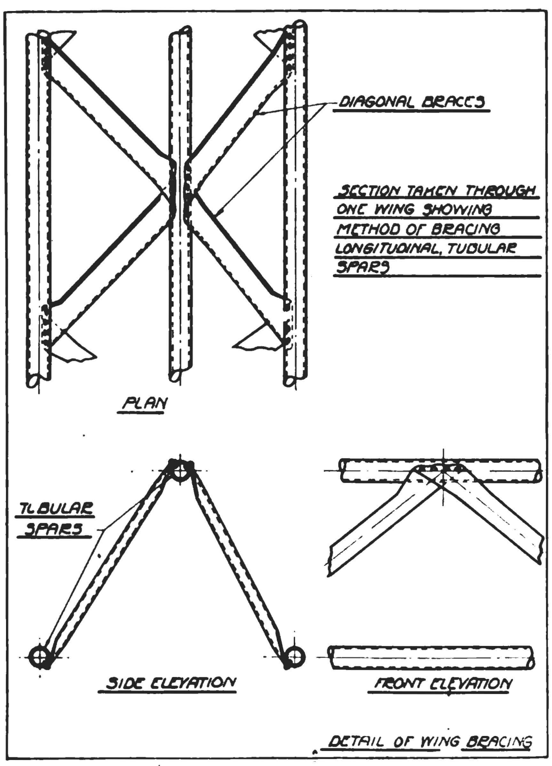

DIAGONAL BRACES
SECTION TAKEN THROUGH ONE WING SHOWING METHOD OF BRACING LONGITUDINAL, TUBULAR SPARS
PLAN
TUBULAR SPARS
SIDE ELEVATION
FRONT ELEVATION
DETAIL OF WING BRACING

Fig. 12.

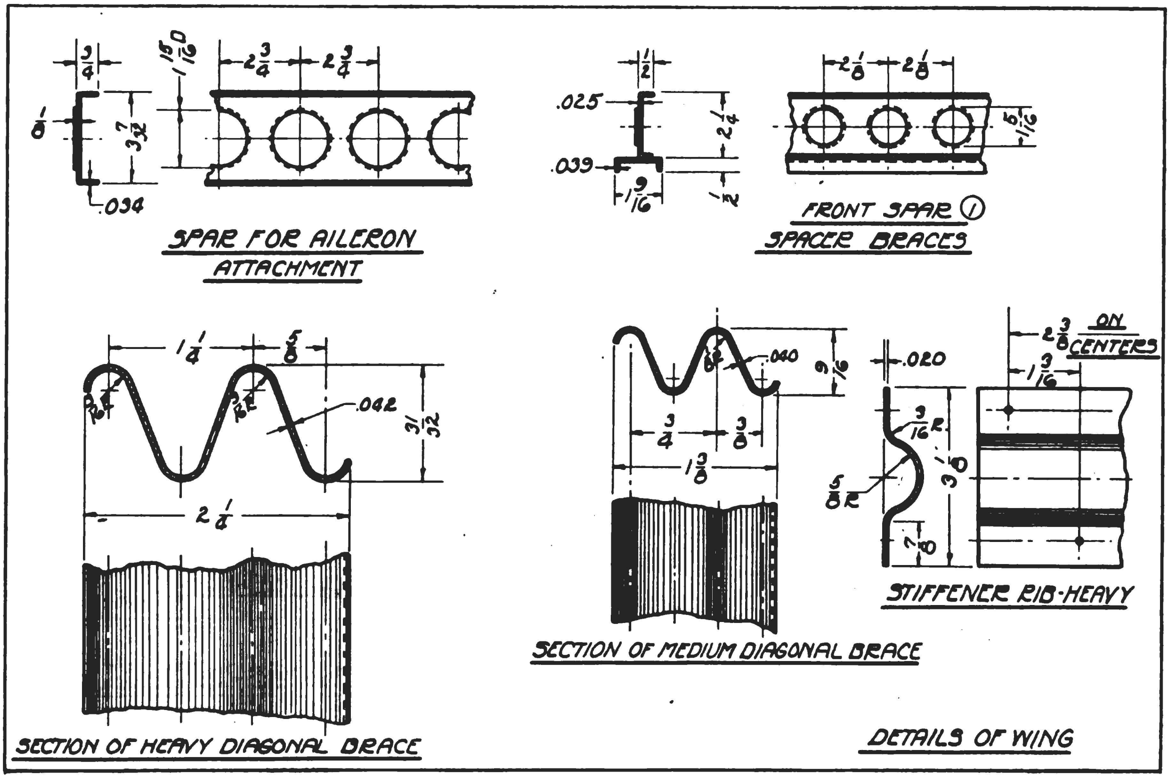
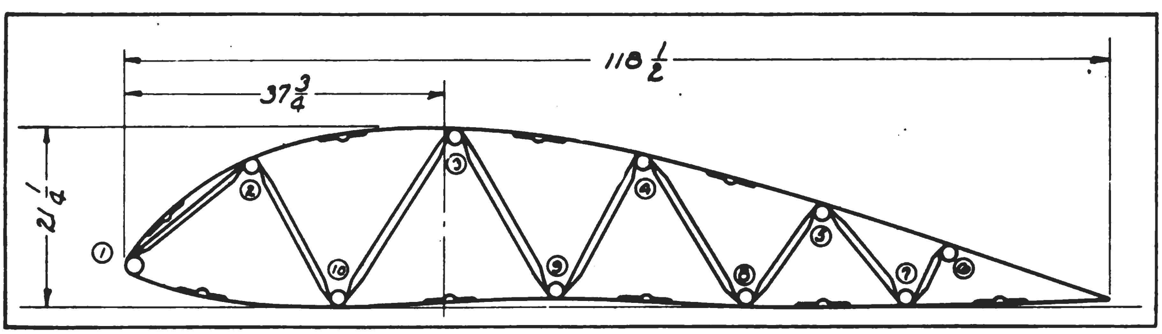


FIG. 13.



Note: Section of wing at point of connection to center section showing location of tubular spars and diagonal braces and stiffener ribs.

FIG. 14.—Section at wing joint.

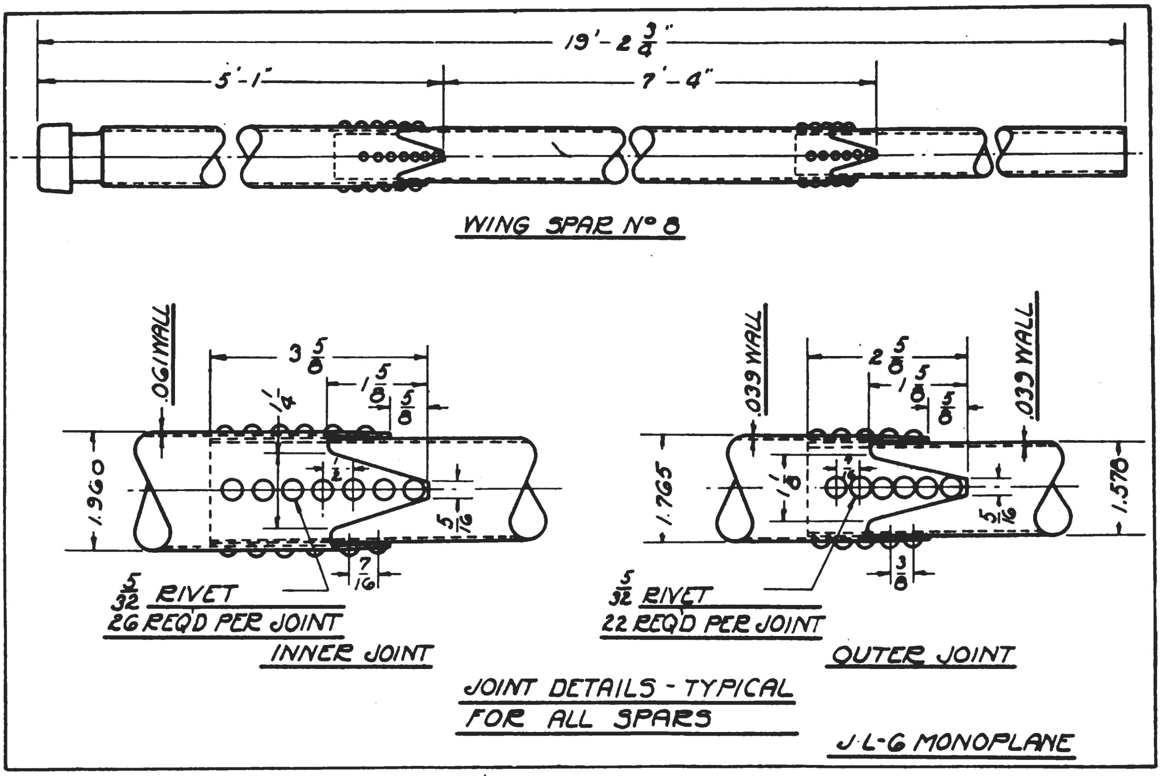


Fig. 15.

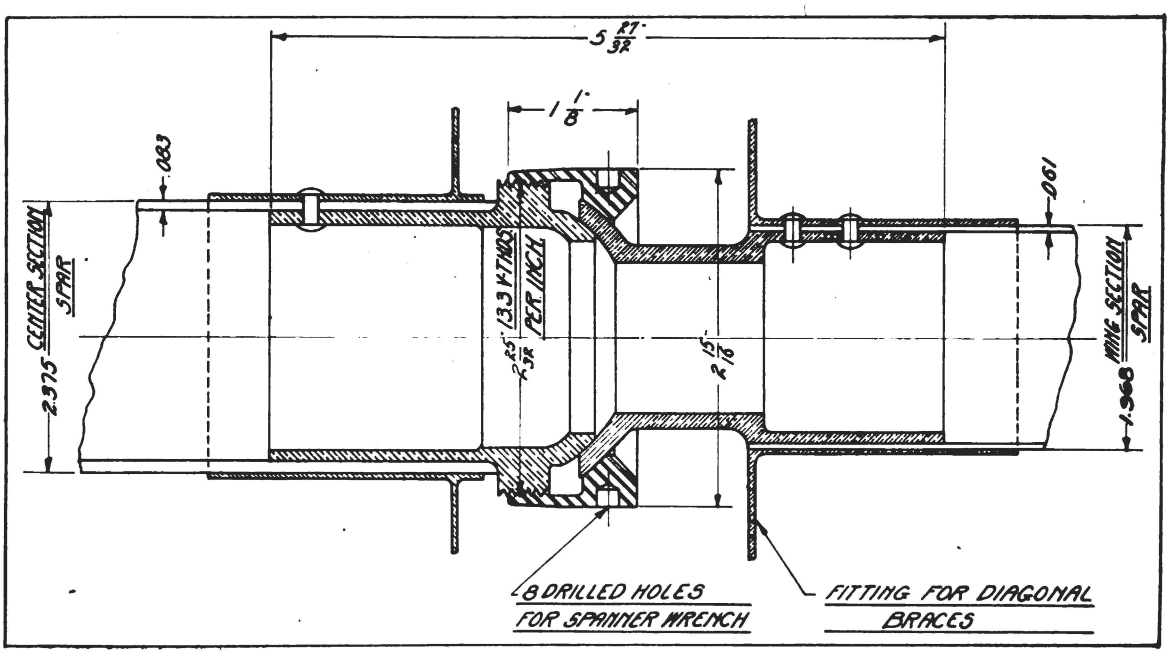


Fig. 16.—Assembly of wing joint.

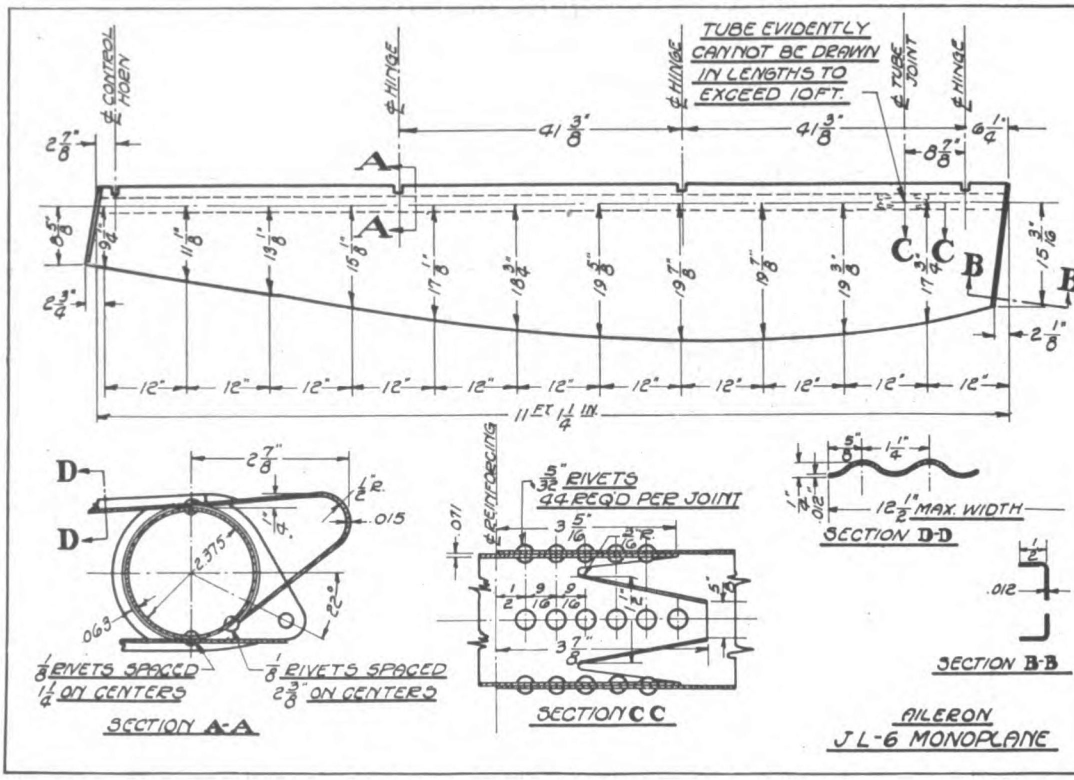


FIG. 17.

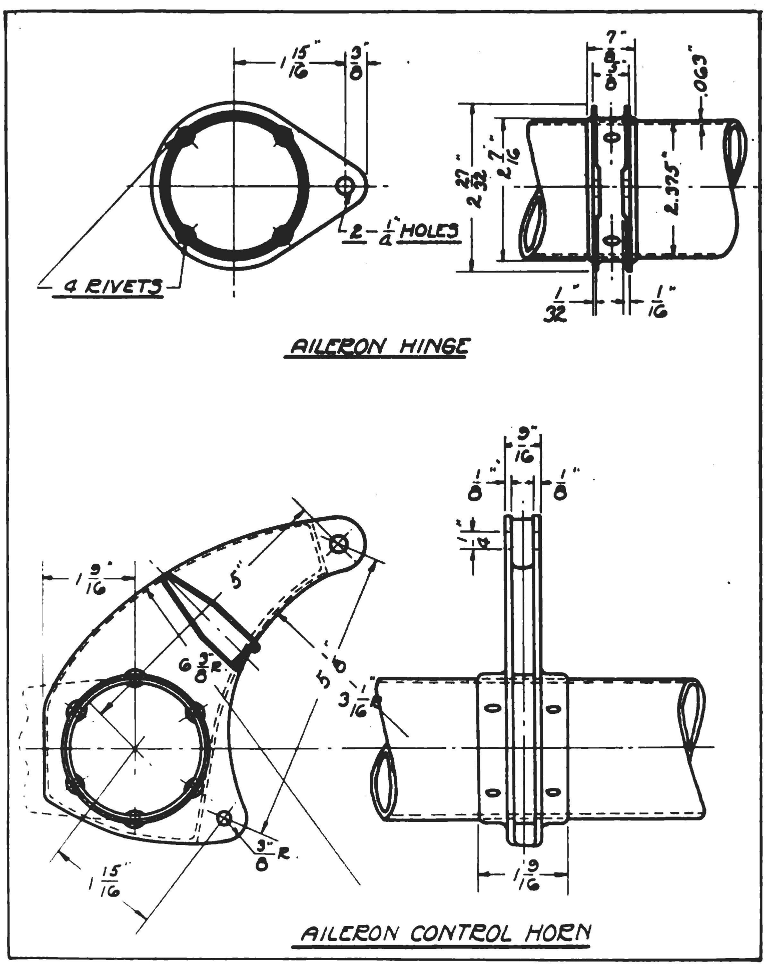
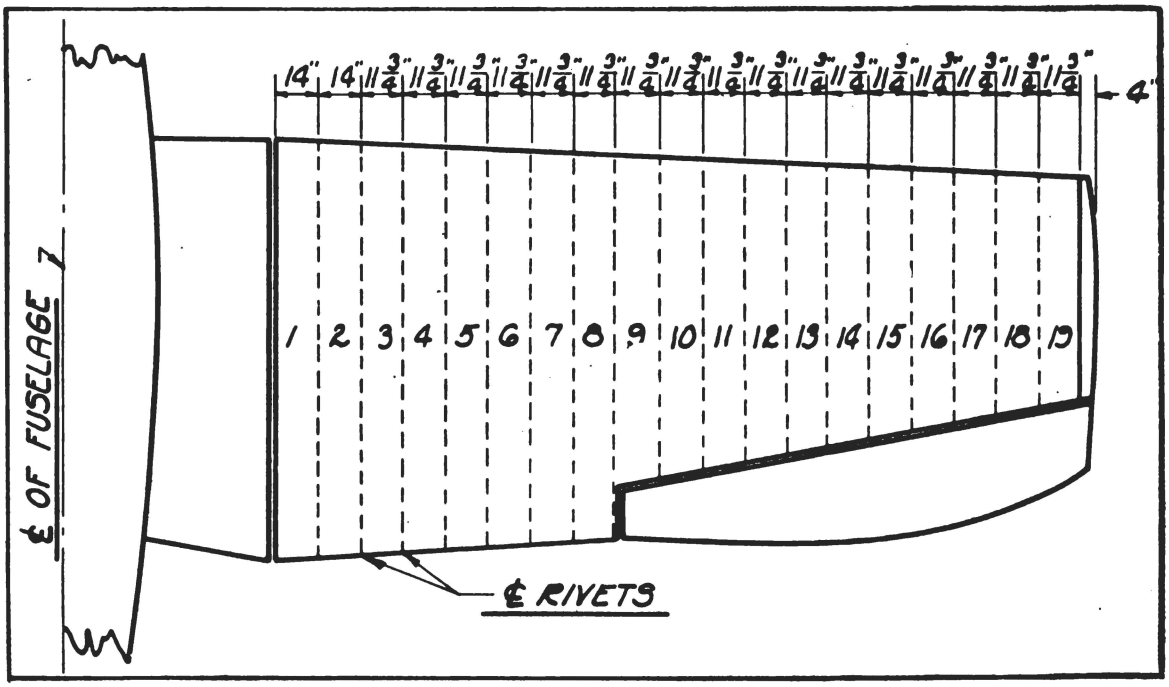


FIG. 18.—Aileron details.



Section.	Thickness.		Section.	Thickness.	
	Top cover.	Bottom cover.		Top cover.	Bottom cover.
1	0.021	0.021	11	0.012	0.012
2	.021	.021	12	.012	.012
3	.016	.016	13	.012	.012
4	.016	.016	14	.012	.012
5	.016	.016	15	.012	.012
6	.016	.016	16	.012	.012
7	.016	.016	17	.012	.012
8	.012	.012	18	.012	.012
9	.012	.012	19	.012	.012
10	.012	.012			

Fig. 19.—Thickness of wing covering.

TABLE OF WEIGHTS AND AREAS.

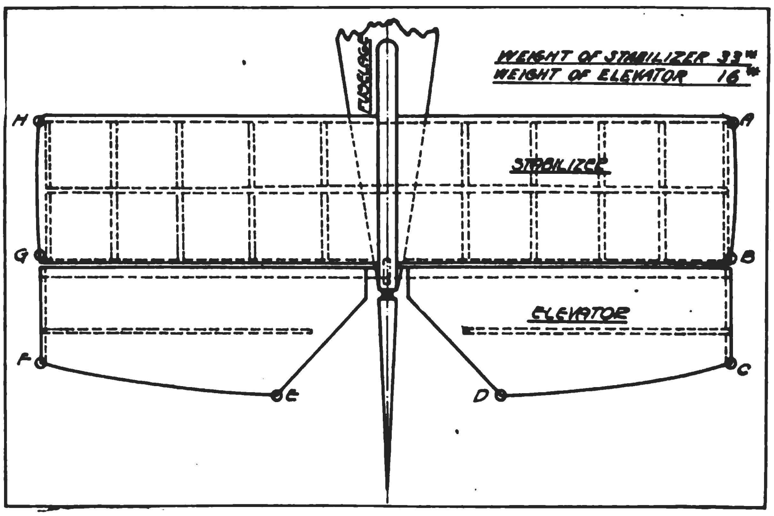
Item.	Weight in pounds.	Area in square feet.	Pounds per square foot.	Remarks.
2 wings with ailerons	428	335.2	1.278	Wing area from wing joint out to tip.
2 ailerons	30	35.4	.85	
Center section	168	92.4	1.825	Section between wing joints included under fuselage.
Wing area under fuselage	....	42	....	Part of fuselage bottom.
Total area from tip to tip	....	430	....	Including part of wing which forms fuselage bottom.
Stabilizer	33	28	1.17	Stabilizer built in one piece.
Elevator	16	20.8	.77	Both sides built on same spar.
Rudder	9.5	11.5	.82	
Fin	5	5	.94	
Tail skid	6.94	....	....	Built up of sheet steel.
Total weight of airplane as in flight	3,910	(1)	10.9	Weight is with pilots, passengers, gas, water, oil, instruments, etc.
Total area of wings, including fuselage section	596	385.6	1.54	

[1] Total area, 385.6, effective.

TABLE OF WEIGHTS OF CORRUGATED DURALUMIN.

Thickness.	½ square foot.	1 square foot.	Remarks.
Inch.	*Pound.*	*Pound.*	
0.021	0.085	0.340	With paint on.
.016	.070	.280	Do.
.012	.050	.200	Do.
.021	.080	.320	Do.
.016	.060	.240	Do.
.012	.040	.160	Do.

FIG. 20.



RESULTS OF STATIC TEST OF ELEVATOR AND STABILIZER.

Load factor.	Deflections measured at points— A	B	C	D	E	F	G	H	Pull on stick.	Load per square foot on— Elevator. Added.	Elevator. Total.	Stabilizer. Added.	Stabilizer. Total.	Remarks.
									Pounds.	*Pounds.*	*Pounds.*			
1	0.1	0.2	0.3	0.1	0.2	0.5	0.3	0.2	55	84	84	169	338	
2	.3	.5	2.1	2.2	2.4	2.1	.7	.3	100	84	168	169	507	
3	.5	.9	4.3	4.8	5.0	4.3	1.1	.6	150	84	252	169	686	Control stick bending control.
4	1.0	1.2	3.3	5.3	6.7	5.1	1.1	.8	....	84	336	169	855	Stick torque tube failed in bending.
4.5	1.1	1.0	4.2	6.4	7.9	6.0	1.1	1.4	....	42	378	84.5	939.5	Test continued on rear control.
5	Deflections discontinued.								....	42	420	84.5	1,024.0	Failure of bulkhead supporting walking beam between first and second linkage of elevator control. Both rivets tore loose and the metal tore. Surfaces showed no signs of failure during test.
5.5	......	......	......	......	......	......	......	......	....	42	462	84.5	1,108.5	
6	......	......	......	......	......	......	......	......	....	42	504	84.5	1,193.0	
6.5	Failure.								....	42	546	84.5	1,277.5	

FIG. 21.

111870—22——3

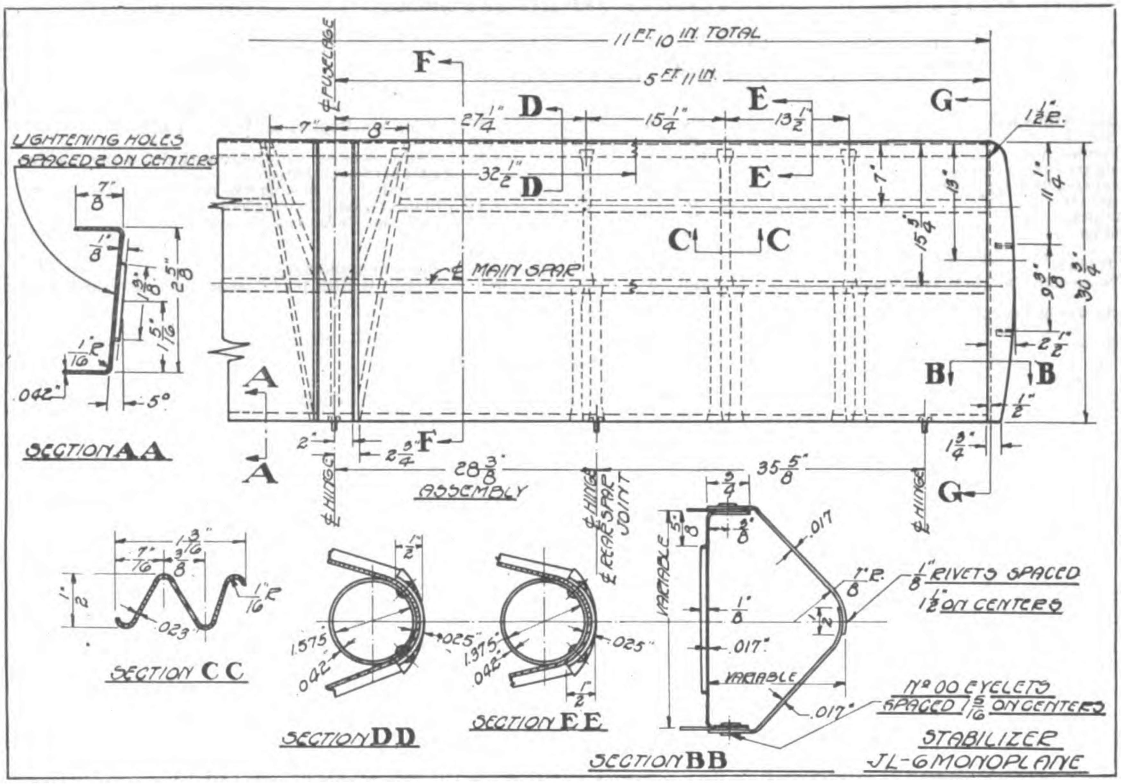

11 FT. 10 IN. TOTAL
5 FT. 11 IN.
LIGHTENING HOLES SPACED 2 ON CENTERS
℄ FUSELAGE
℄ MAIN SPAR
ASSEMBLY
℄ HINGE
℄ HINGE ℄ REAR SPAR JOINT
SECTION AA
SECTION CC
SECTION DD
SECTION EE
SECTION BB
VARIABLE
1/8" RIVETS SPACED 1 1/2" ON CENTERS
No. 00 EYELETS SPACED 7/16 ON CENTERS
STABILIZER
JL-6 MONOPLANE

FIG. 22.

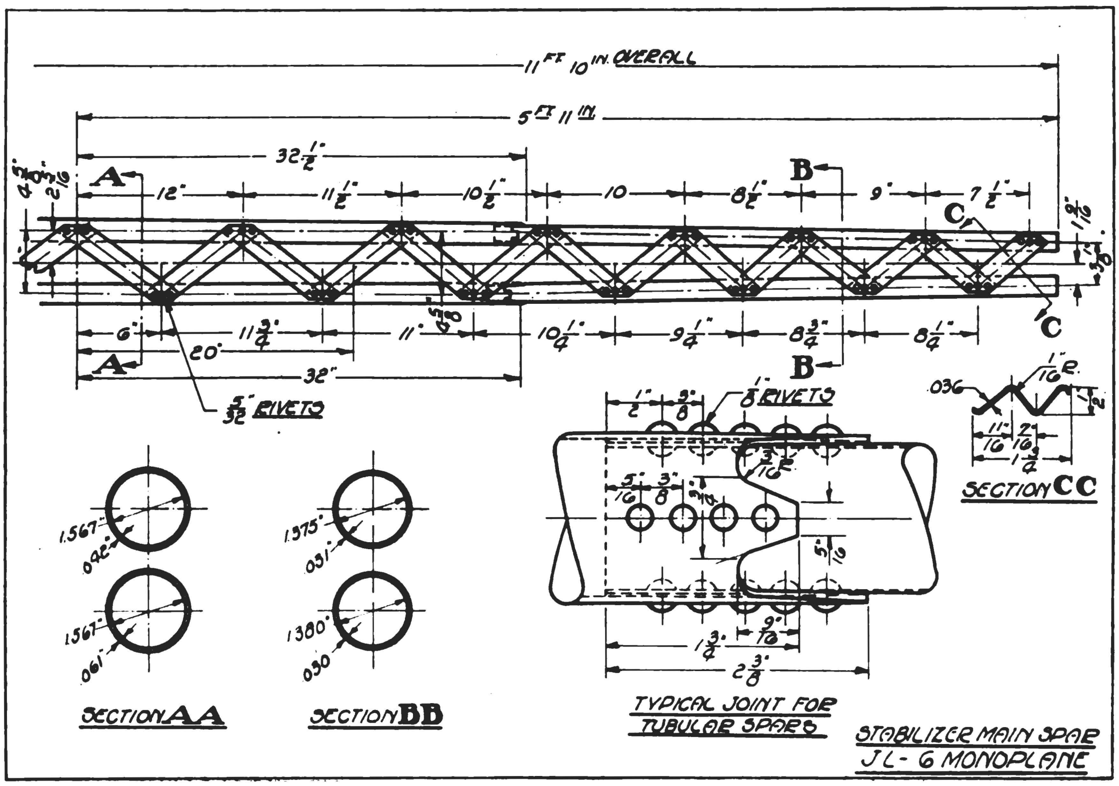

11 FT. 10 IN. OVERALL
5 FT. 11 IN.
5/32" RIVETS
1/8" RIVETS
SECTION AA
SECTION BB
TYPICAL JOINT FOR TUBULAR SPARS
SECTION CC
STABILIZER MAIN SPAR
JL-6 MONOPLANE

FIG. 23.

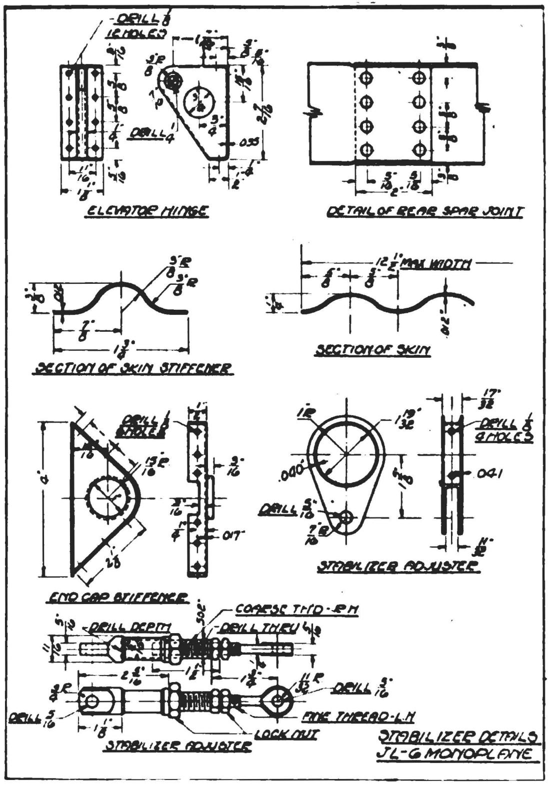


FIG. 24.

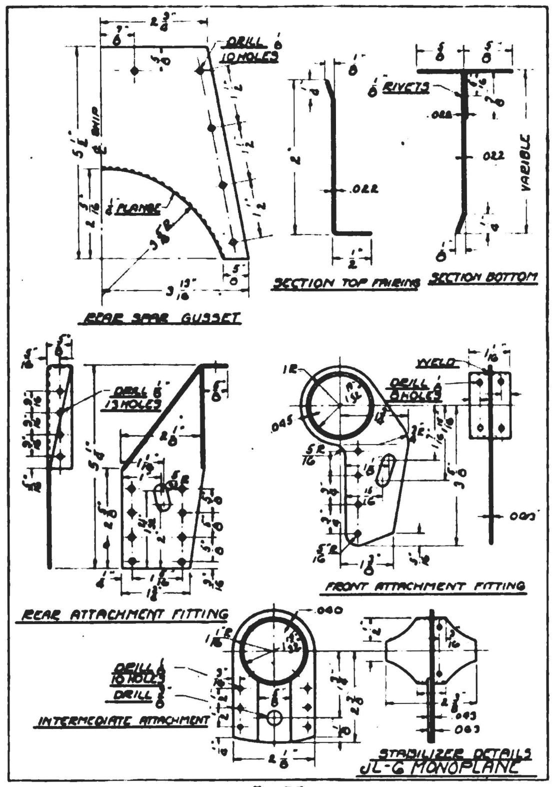


FIG. 25.

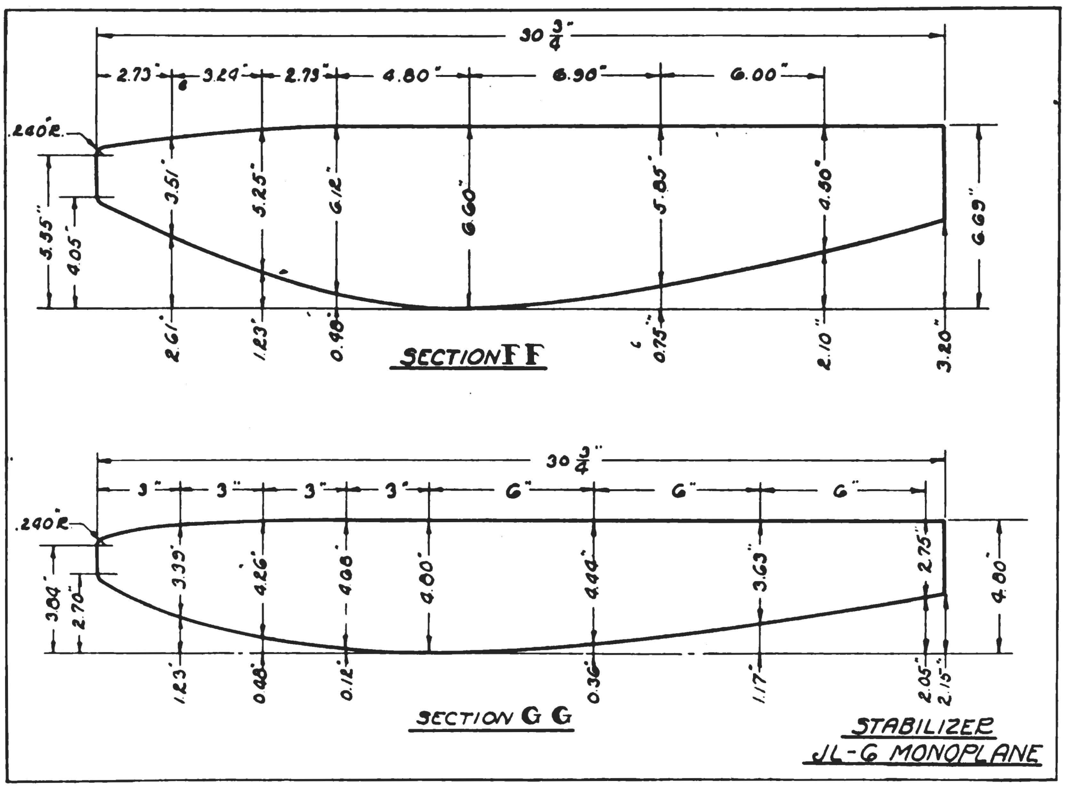


FIG. 26.

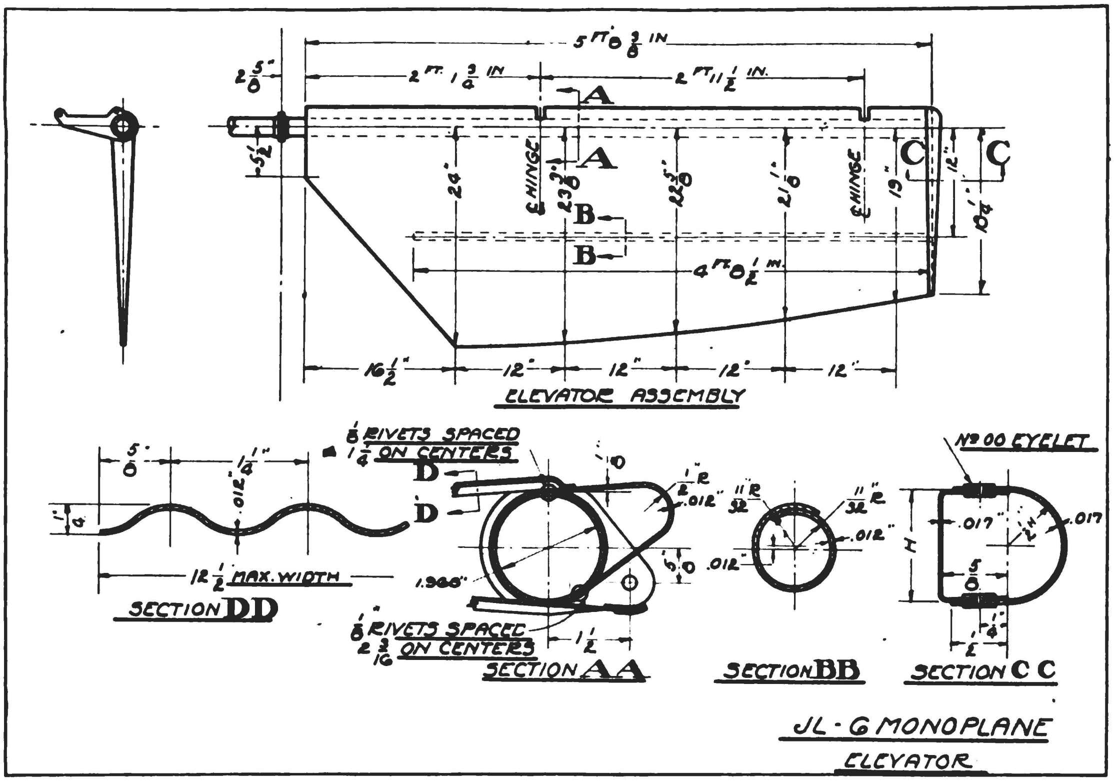

ELEVATOR ASSEMBLY
SECTION DD
SECTION AA
SECTION BB
SECTION C C
No 00 EYELET
JL-6 MONOPLANE
ELEVATOR

FIG. 27.

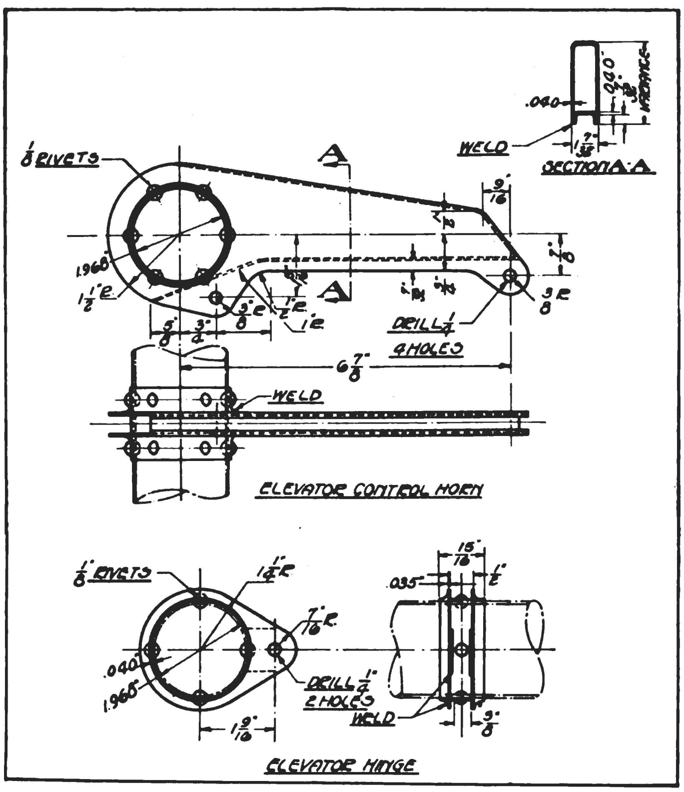
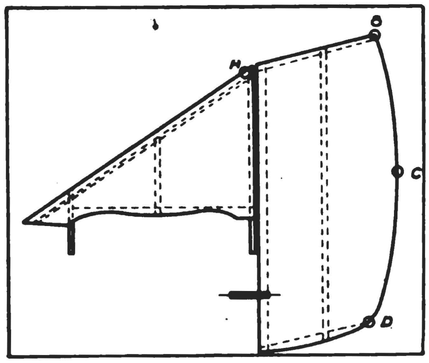

ELEVATOR CONTROL HORN
SECTION A-A
WELD
ELEVATOR HINGE

FIG. 28.



RESULTS OF RUDDER AND FIN TEST.

Load factor.	Pounds per square foot.	Deflection at—				Pull on control.	Load per square foot on—				Total load on vertical surfaces (pounds).
		A	B	C	D		Rudder.		Fin.		
							Added.	Total.	Added.	Total.	
1	5	0.1	0.3	0.2	0.1	100	50.5	50.5	34	34	84.5
2	10	.3	2.4	2.5	1.9	180	50.5	101.0	34	68	169.0
3	15	.5	4.4	4.4	3.4	....	50.5	151.5	34	102	253.5
4	20	.7	6.5	6.6	5.1	....	50.5	202.0	34	136	338.0
4.5	22.5	.9	8.0	8.4	6.5	....	25.25	227.25	17	143	370.25
5	25		Failure.			....	25.25	252.5	17	220	472.5
5.5	27.5	....	....	....	....	....	....	....	....	....	....
6	30	....	....	....	....	....	....	....	....	....	....

NOTE.—When average load was 22.5 pounds per square foot left rudder control pedal twisted. At an average loading of 25 pounds per square foot the left rudder pedal of right control failed.

FIG. 29.

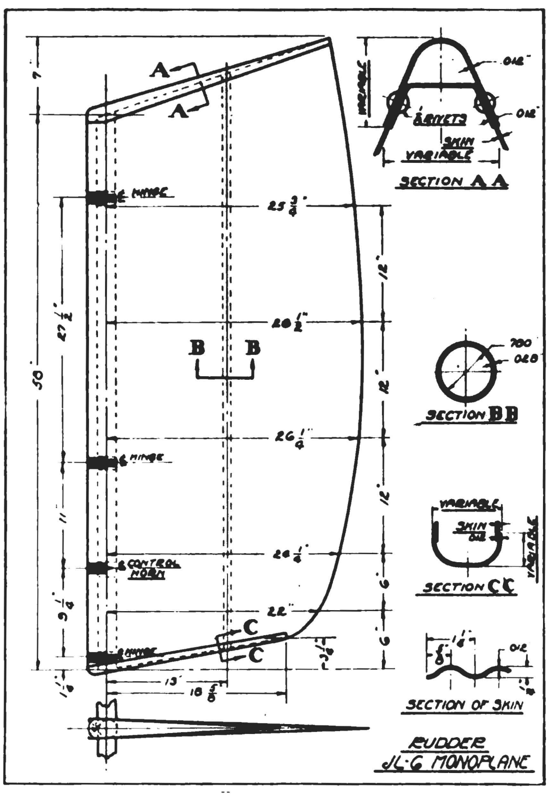


FIG. 30.

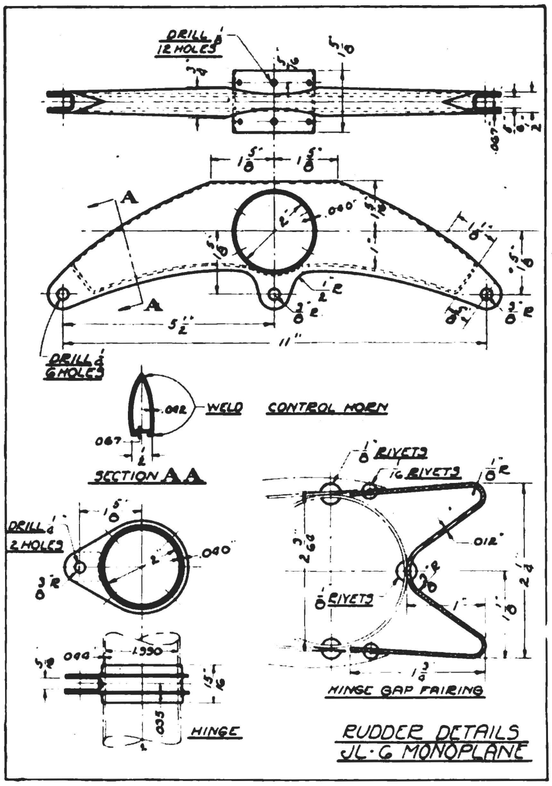


Fig. 31.

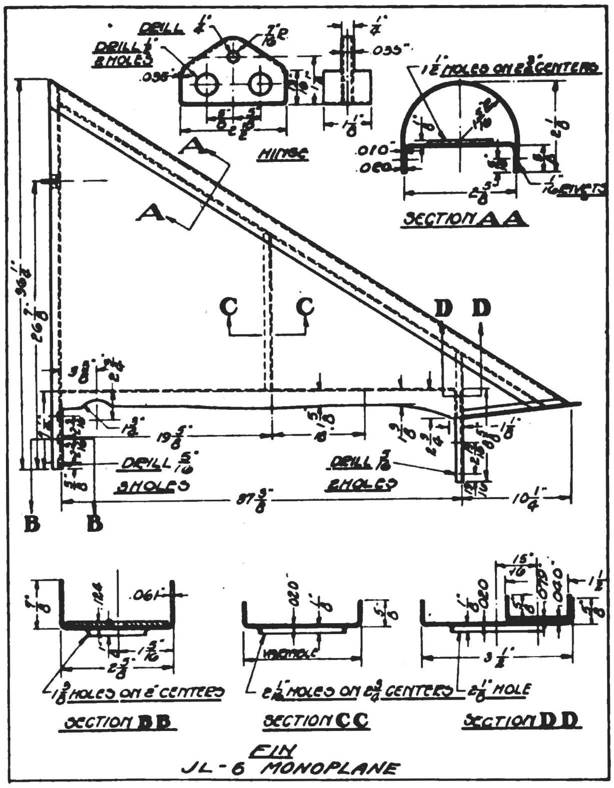


Fig. 32.

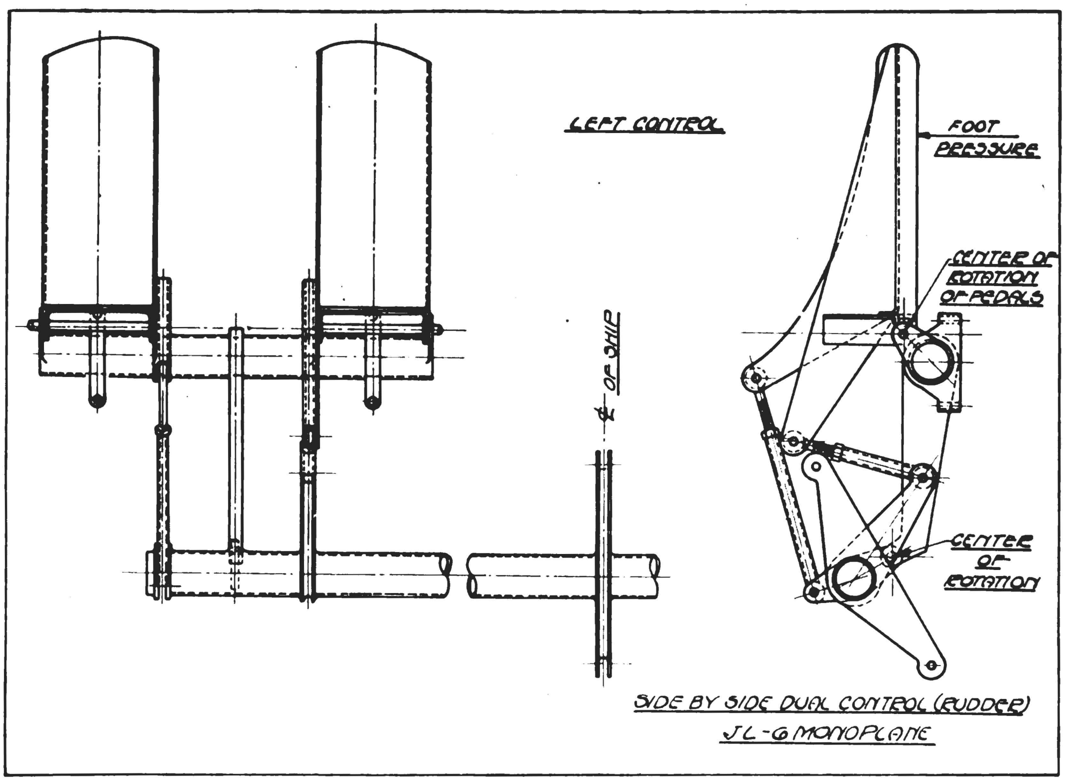


Fig. 33.

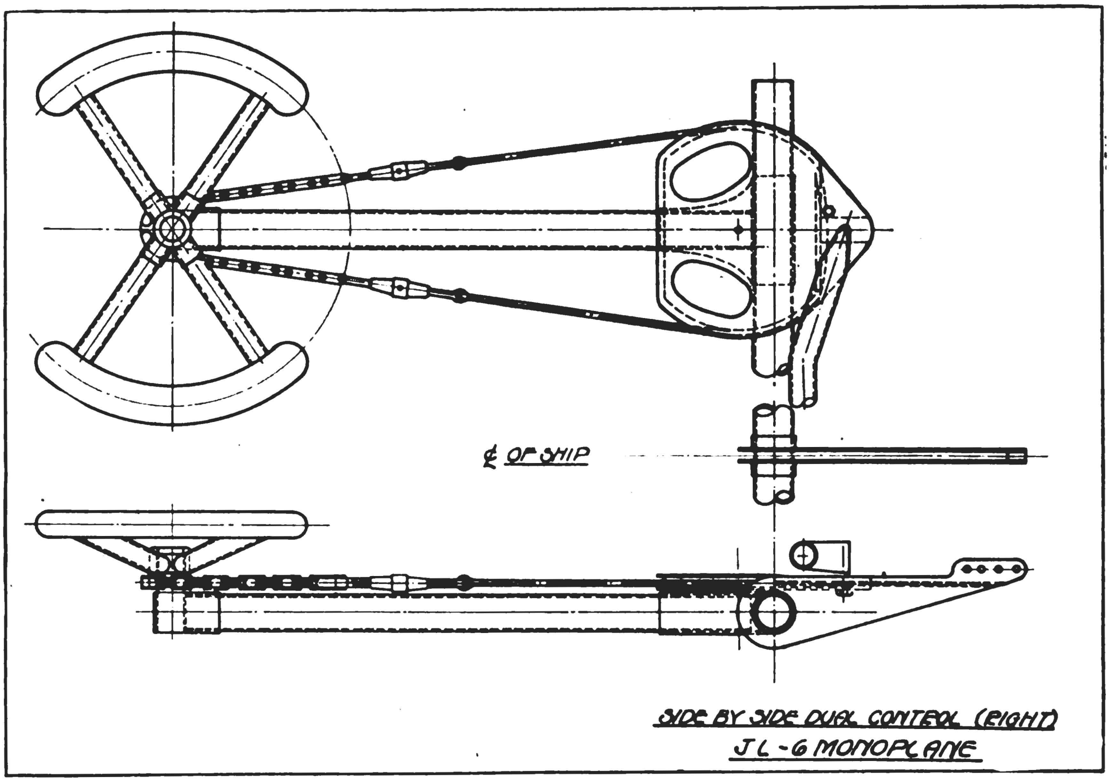


FIG. 34.

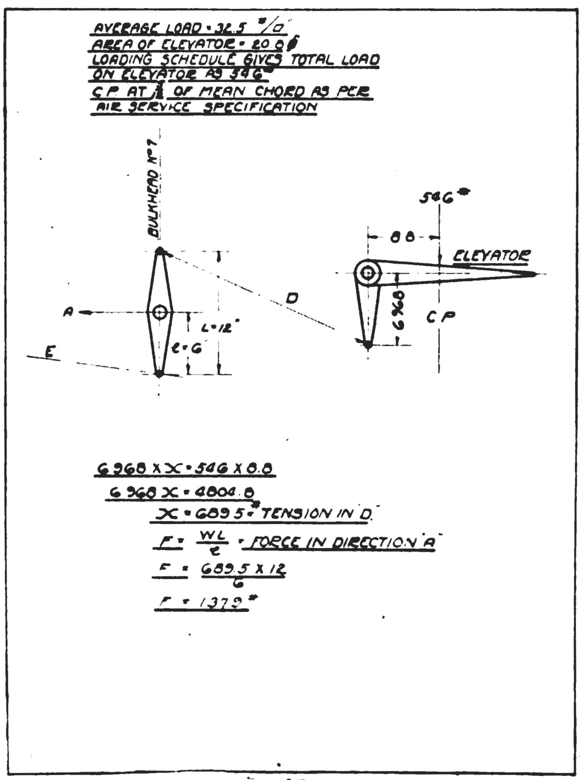
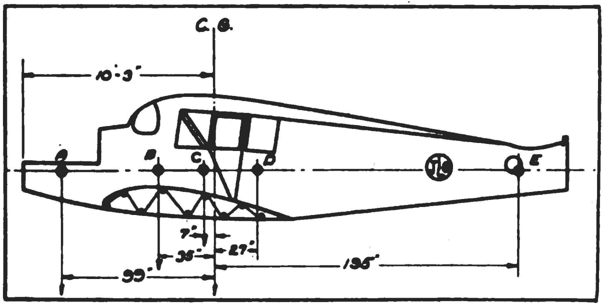


FIG. 35.—Forces causing No. 7 bulkhead failure.

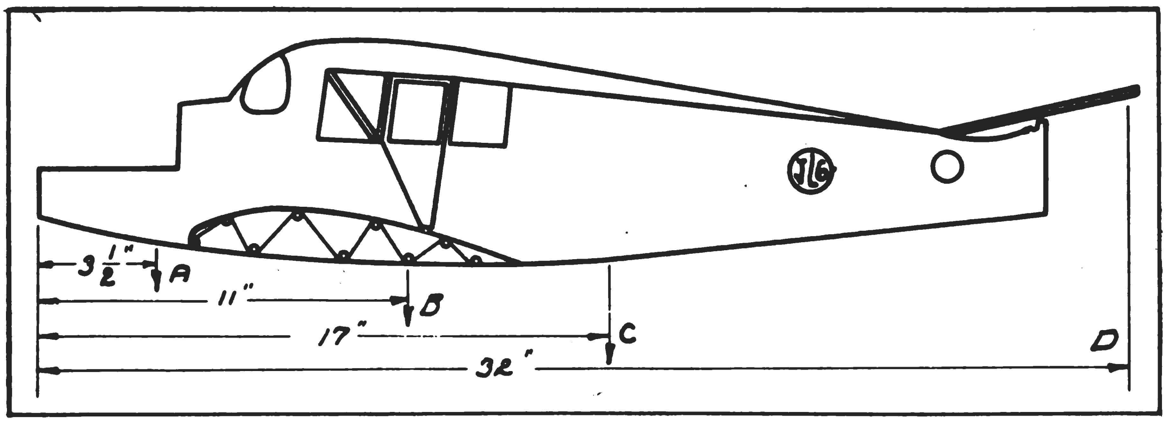


LOADING SCHEDULE AND TOTAL LOADS.

Load factor.	Load, in pounds, at—					Total load.	Remarks.
	A	B	C	D	E		
2	1,588	900	460	700	892	4,480	
2.5	1,985	1,125	625	875	1,115	5,725	
3	2,382	1,350	790	1,050	1,338	6,910	
3.5	2,779	1,575	955	1,225	1,561	8,095	
4	3,176	1,800	1,120	1,400	1,784	9,280	
4.5	3,573	2,025	1,285	1,575	2,007	10,465	
5	3,970	2,250	1,450	1,750	2,230	11,650	Fuselage buckled at seams.
5.5	4,367	2,475	1,615	1,925	2,453	12,835	
6	4,764	2,700	1,780	2,100	2,676	14,020	
6.5	5,161	2,925	1,945	2,275	2,899	15,205	
7	5,558	3,150	2,110	2,450	3,122	16,390	Failure; motor support collapsed.

NOTE.—The forward end collapsed before the jacks were free under the load at (E). After the fuselage was counterbalanced the load was imposed at (E). The next failure occurred aft of bulkhead No. 4.

FIG. 36.



Load factor.	Deflections at—				Remarks.
	A	B	C	D	
2	0.3	0.1	0.1	0.3	
2.5	.3	.2	.2	.6	
3	.7	.4	.4	.7	
3.5	.7	.5	.5	.9	
4	.7	.5	.5	1.0	
4.5	.7	.5	.6	1.1	
5	.8	.5	.7	1.4	Fuselage buckled at seams.
5.5	....	.6	.8	1.6	
6	....	.6	.9	1.7	
6.5	Deflections discontinued.				
7	Failure.				Engine support collapsed.
7.5	Failure.				Rear part of fuselage collapsed.

FIG. 37.

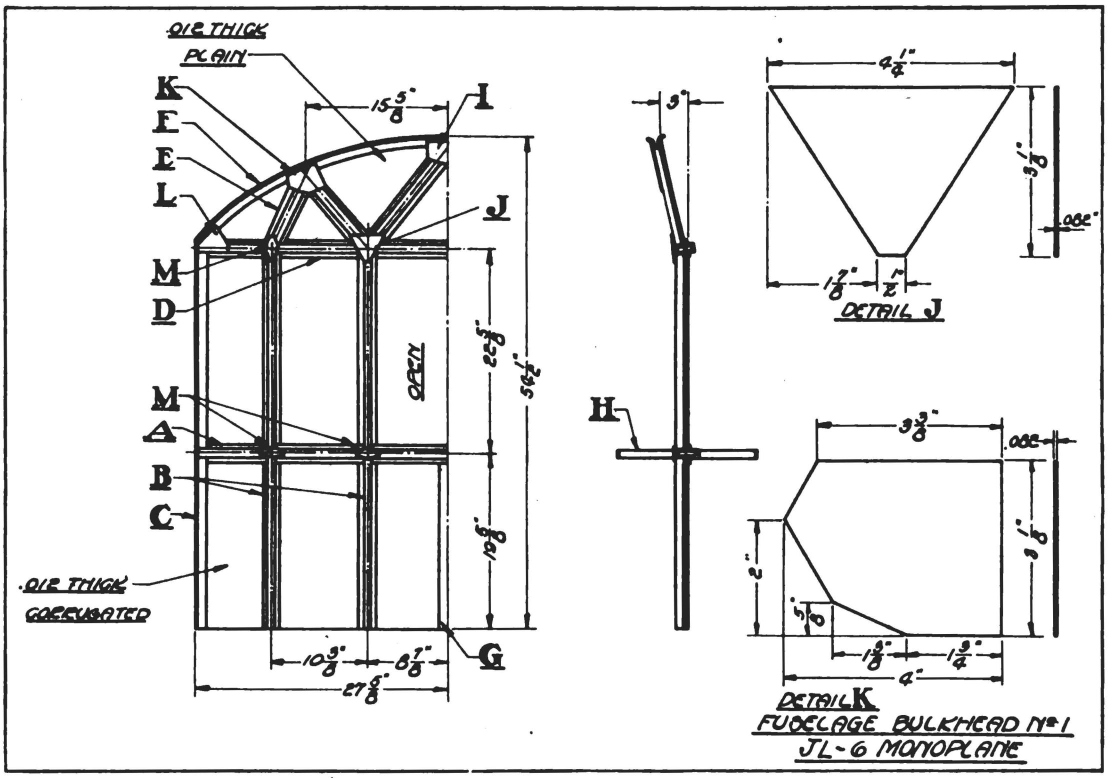

.012 THICK
PLAIN
OPEN
.012 THICK
CORRUGATED
DETAIL J
DETAIL K
FUSELAGE BULKHEAD Nº 1
JL-6 MONOPLANE

Fig. 38.

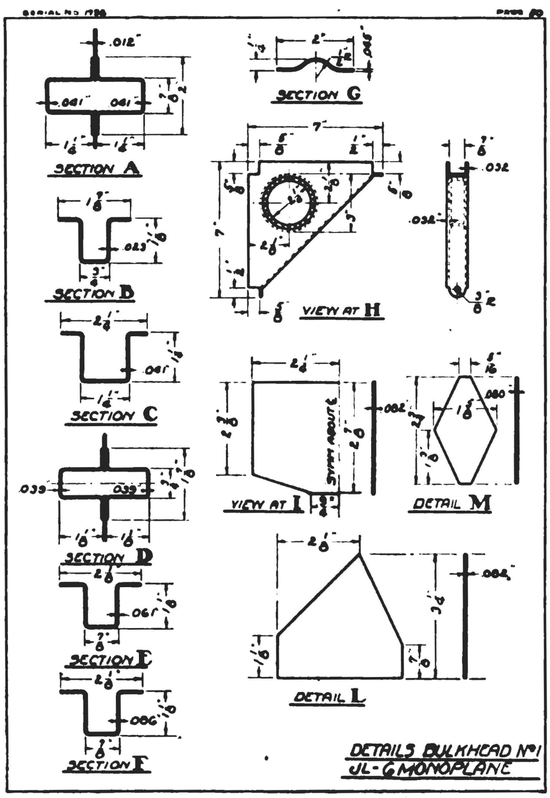

SECTION A
SECTION B
SECTION C
SECTION D
SECTION E
SECTION F
SECTION G
VIEW AT H
VIEW AT I
DETAIL M
DETAIL L
DETAILS BULKHEAD Nº1
JL-6 MONOPLANE

Fig. 39.

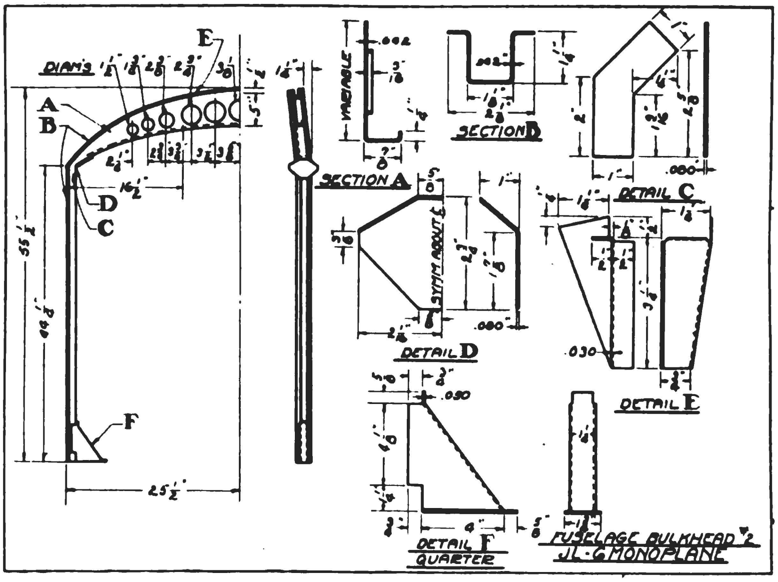

DIAM'S
SECTION A
SECTION B
DETAIL C
DETAIL D
DETAIL E
DETAIL F
QUARTER
SYMM. ABOUT ℄
VARIABLE
FUSELAGE BULKHEAD No 2
JL-6 MONOPLANE

FIG. 40.

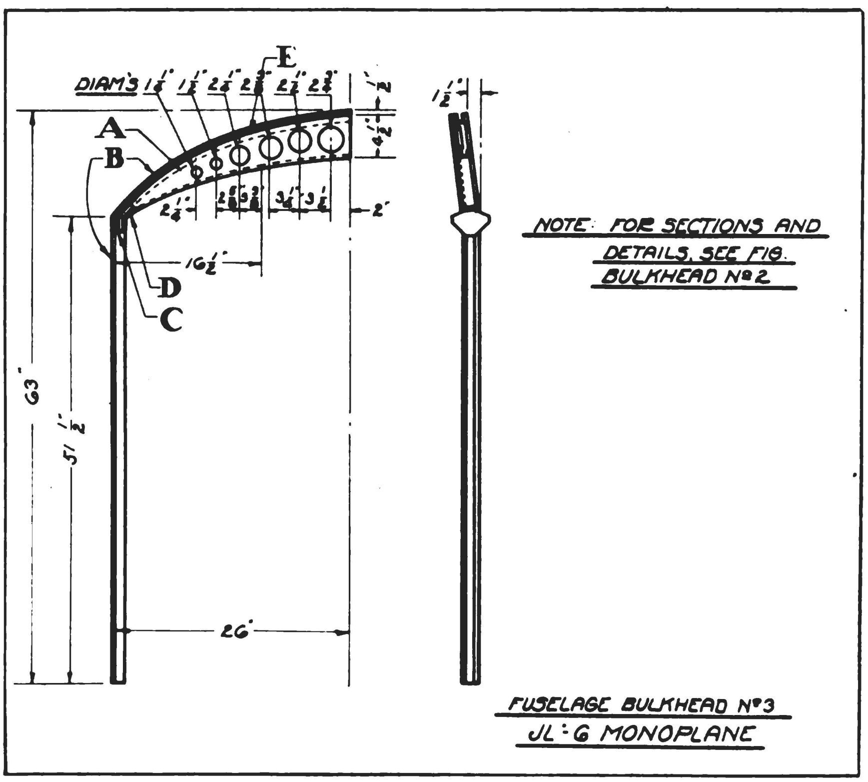

DIAM'S
NOTE: FOR SECTIONS AND
DETAILS, SEE FIG.
BULKHEAD No 2
FUSELAGE BULKHEAD No 3
JL-6 MONOPLANE

FIG. 41.

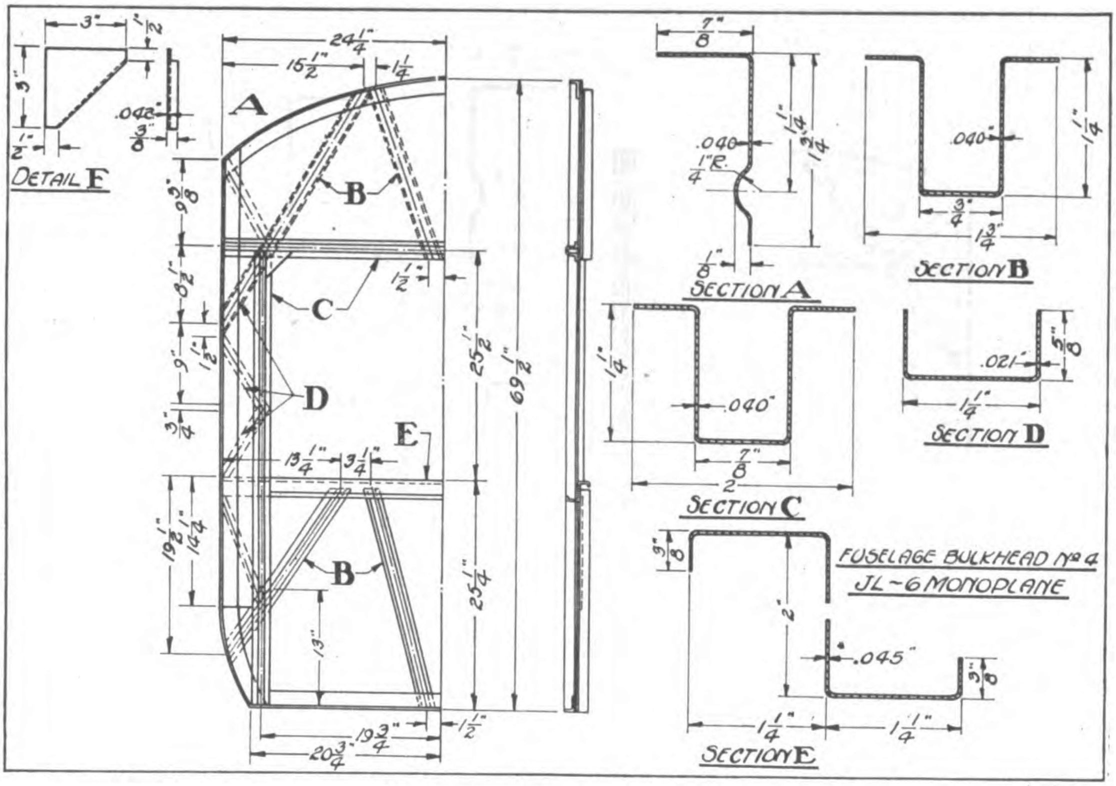

DETAIL F
SECTION A
SECTION B
SECTION C
SECTION D
SECTION E
FUSELAGE BULKHEAD Nº 4
JL-6 MONOPLANE

FIG. 42.

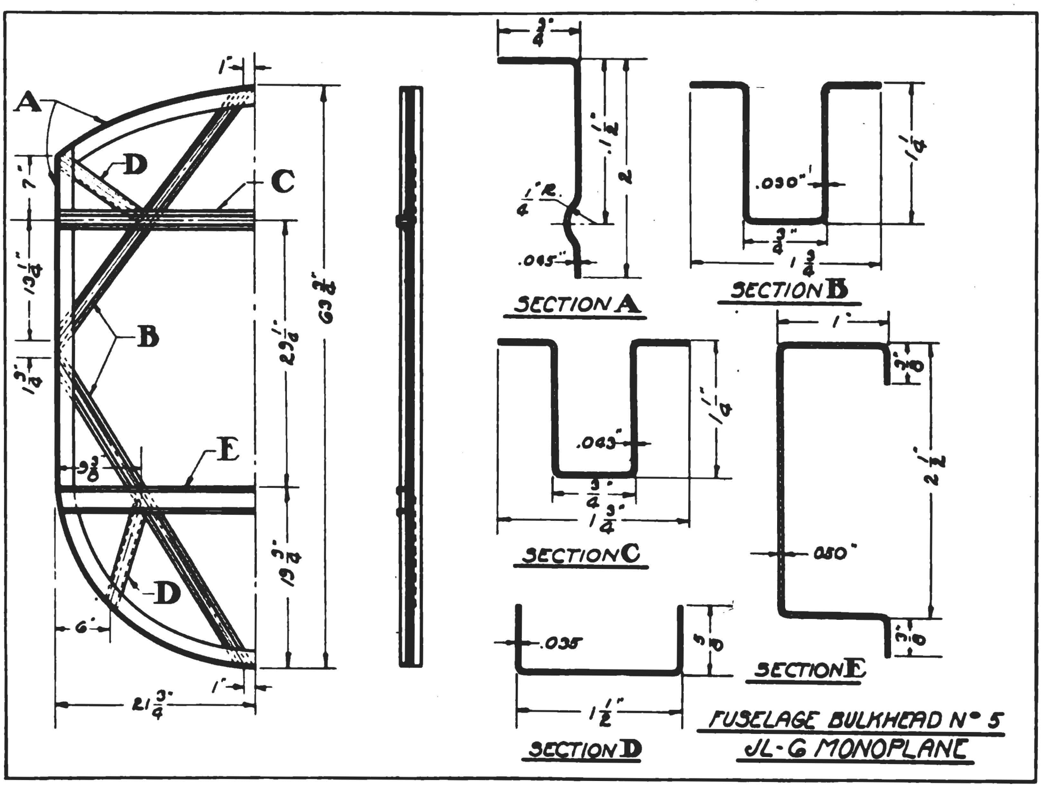

SECTION A
SECTION B
SECTION C
SECTION D
SECTION E
FUSELAGE BULKHEAD Nº 5
JL-6 MONOPLANE

FIG. 43.

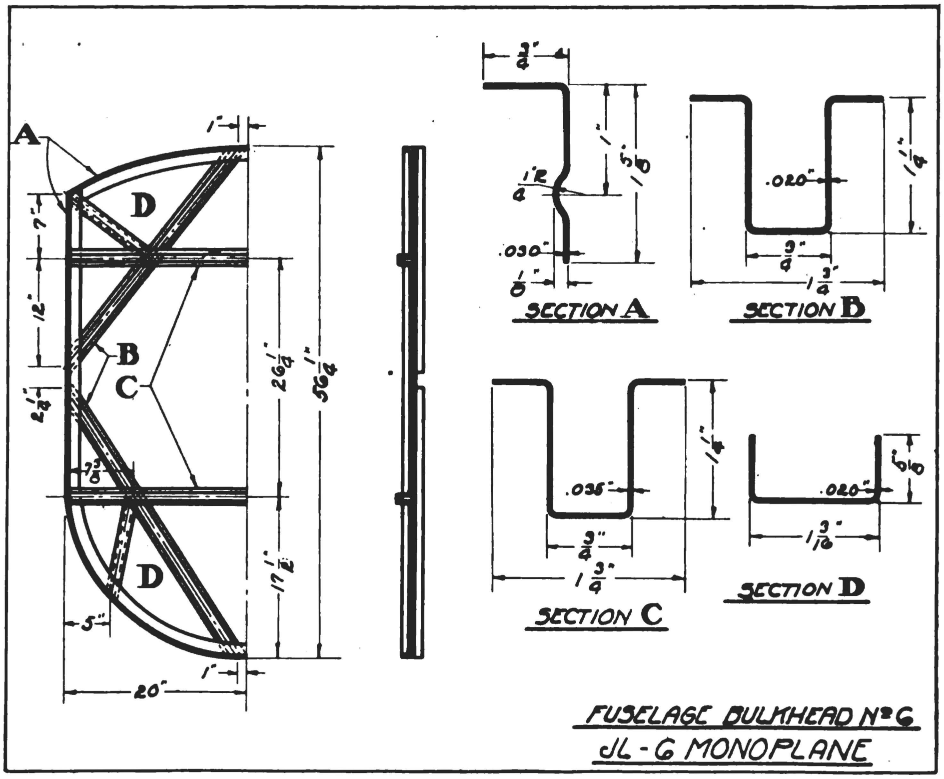

SECTION A
SECTION B
SECTION C
SECTION D
FUSELAGE BULKHEAD No 6
JL-6 MONOPLANE

FIG. 44.

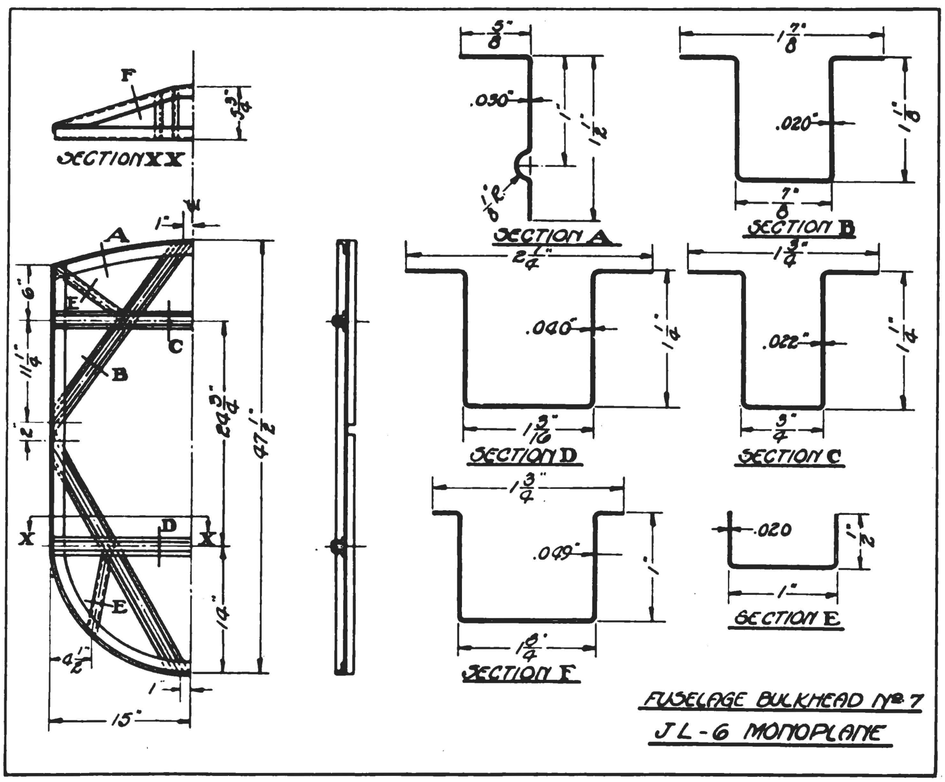

SECTION XX
SECTION A
SECTION B
SECTION C
SECTION D
SECTION E
SECTION F
FUSELAGE BULKHEAD No 7
JL-6 MONOPLANE

FIG 45.

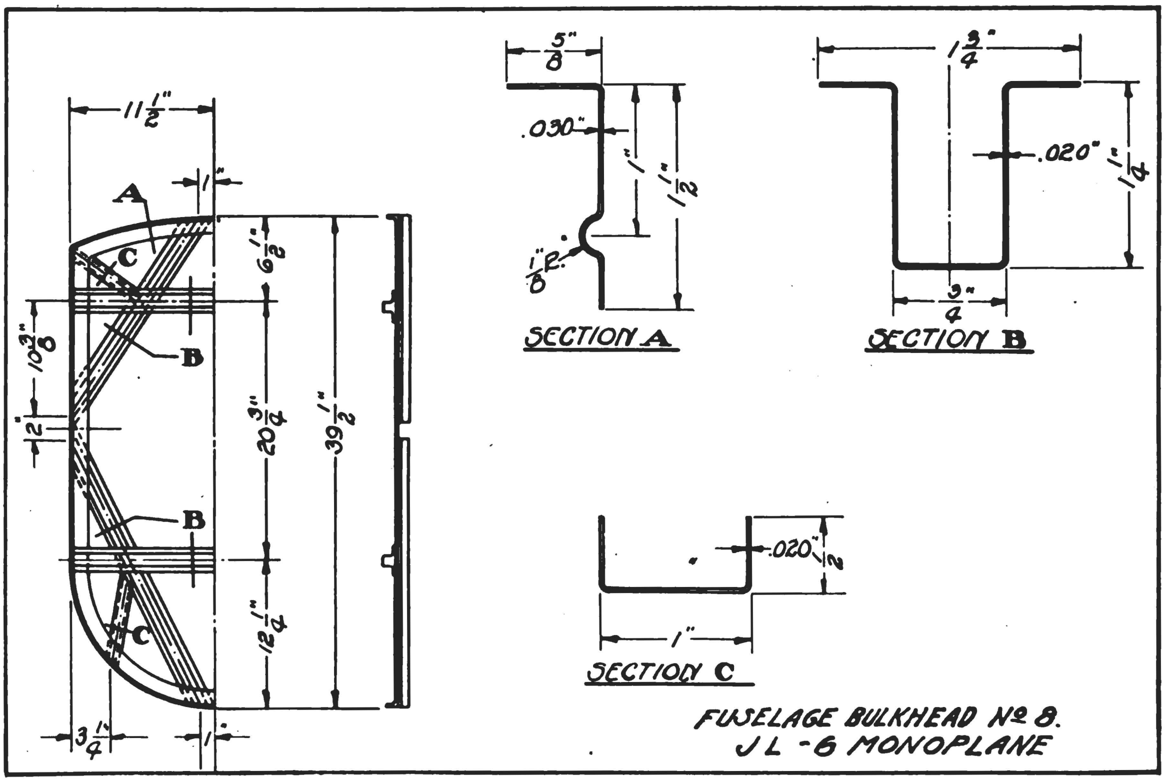

SECTION A
SECTION B
SECTION C
FUSELAGE BULKHEAD Nº 8.
JL-6 MONOPLANE

Fig. 46.

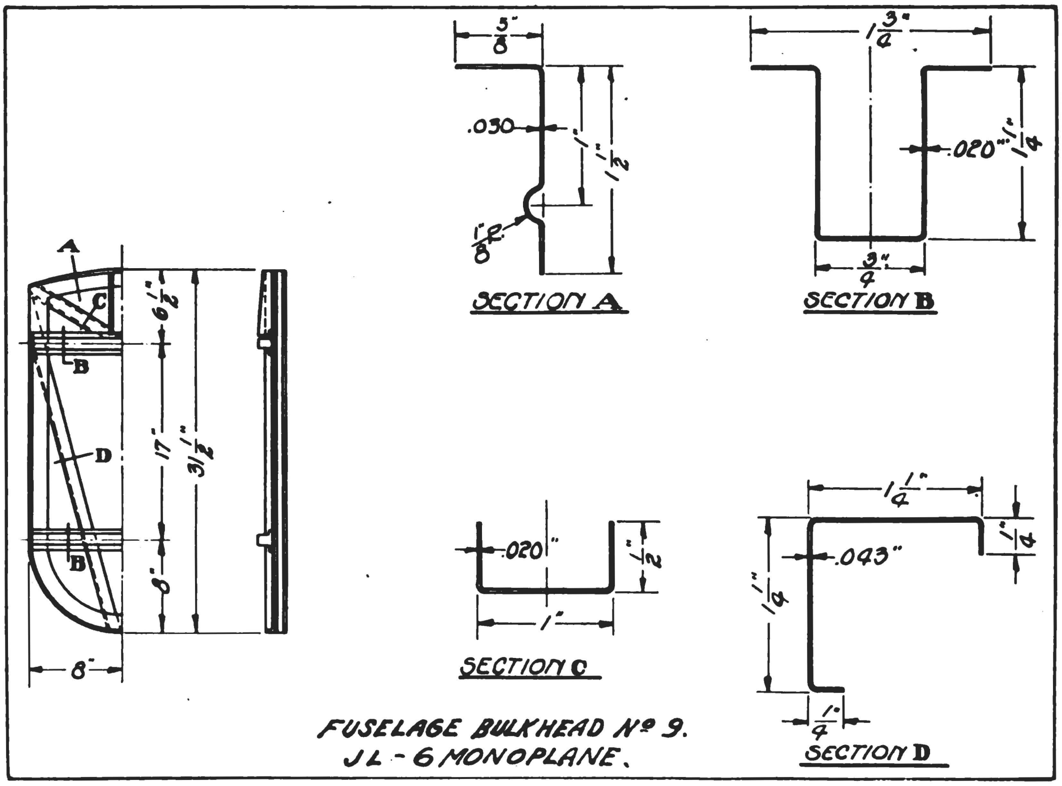

SECTION A
SECTION B
SECTION C
SECTION D
FUSELAGE BULKHEAD Nº 9.
JL-6 MONOPLANE.

Fig. 47.

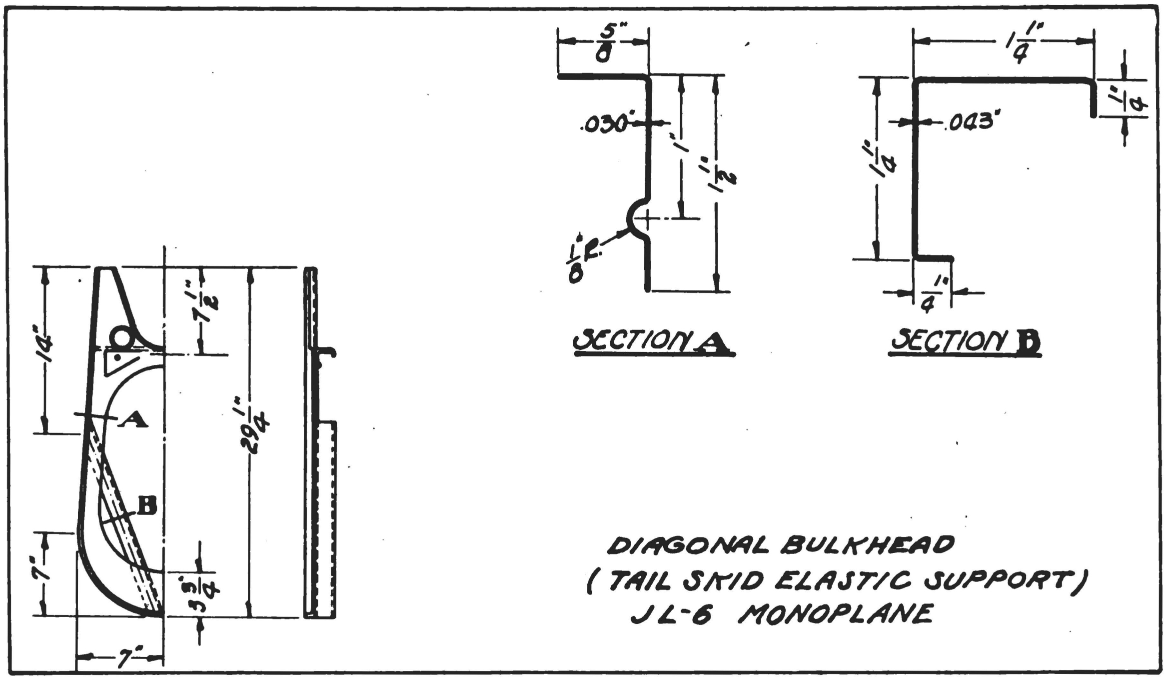

SECTION A
SECTION B
DIAGONAL BULKHEAD
(TAIL SKID ELASTIC SUPPORT)
JL-6 MONOPLANE

Fig. 48.

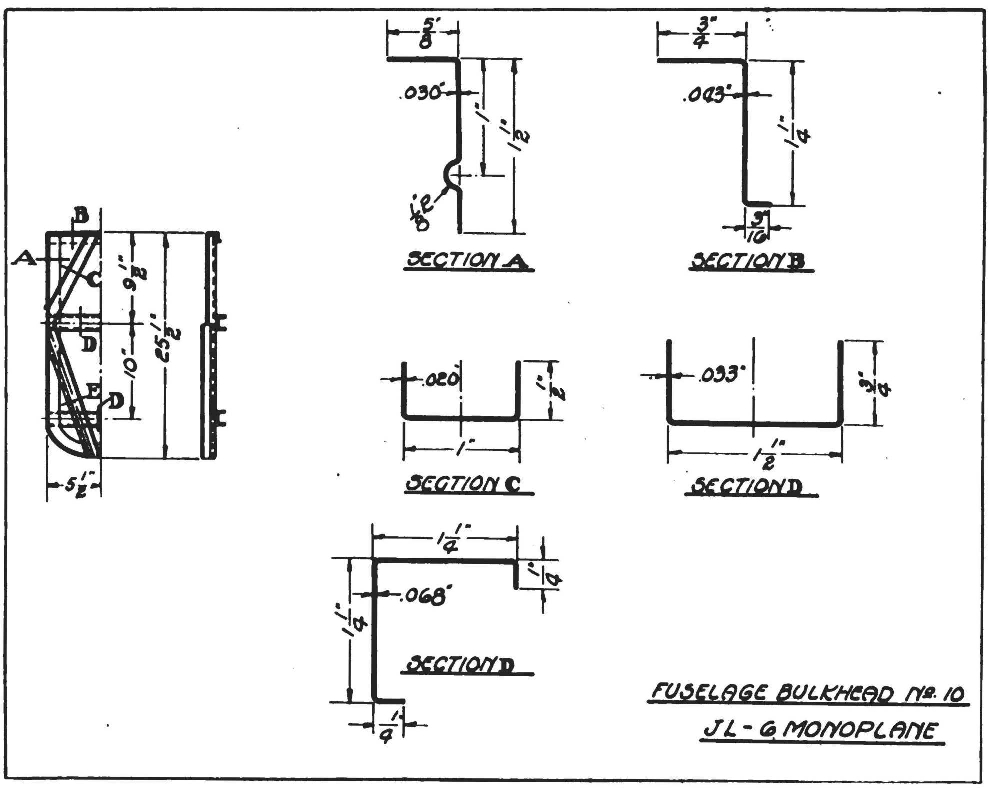

SECTION A
SECTION B
SECTION C
SECTION D
SECTION D
FUSELAGE BULKHEAD No. 10
JL-6 MONOPLANE

Fig. 49.

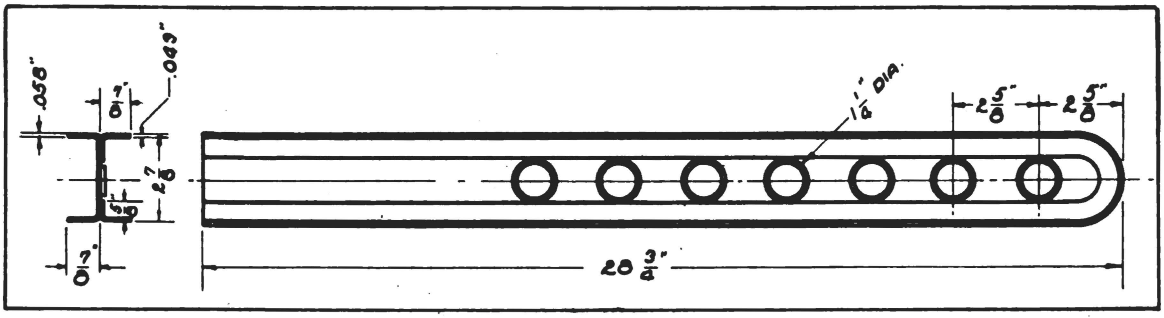


FIG. 50.—Stern post.

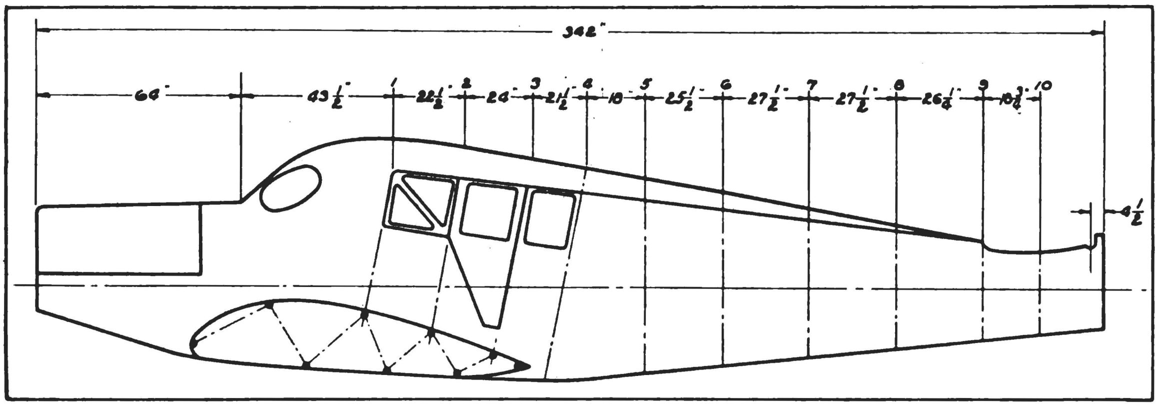


FIG. 51.—Fuselage bulkhead positions.

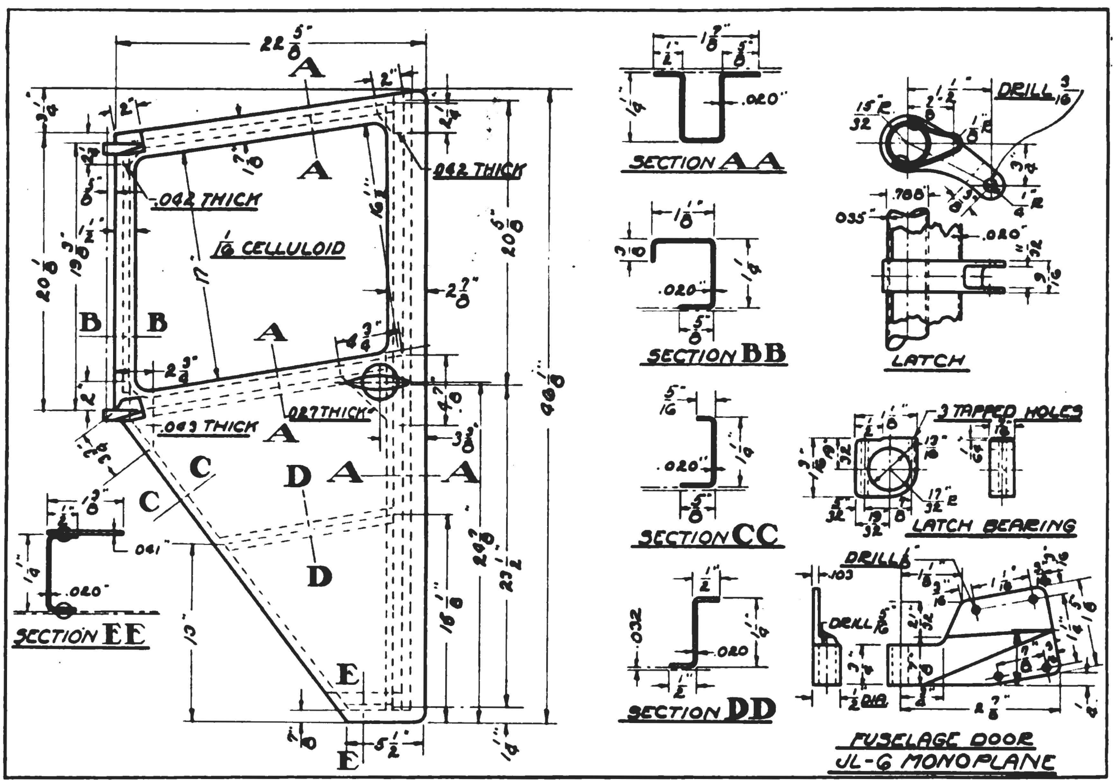


FIG. 52.

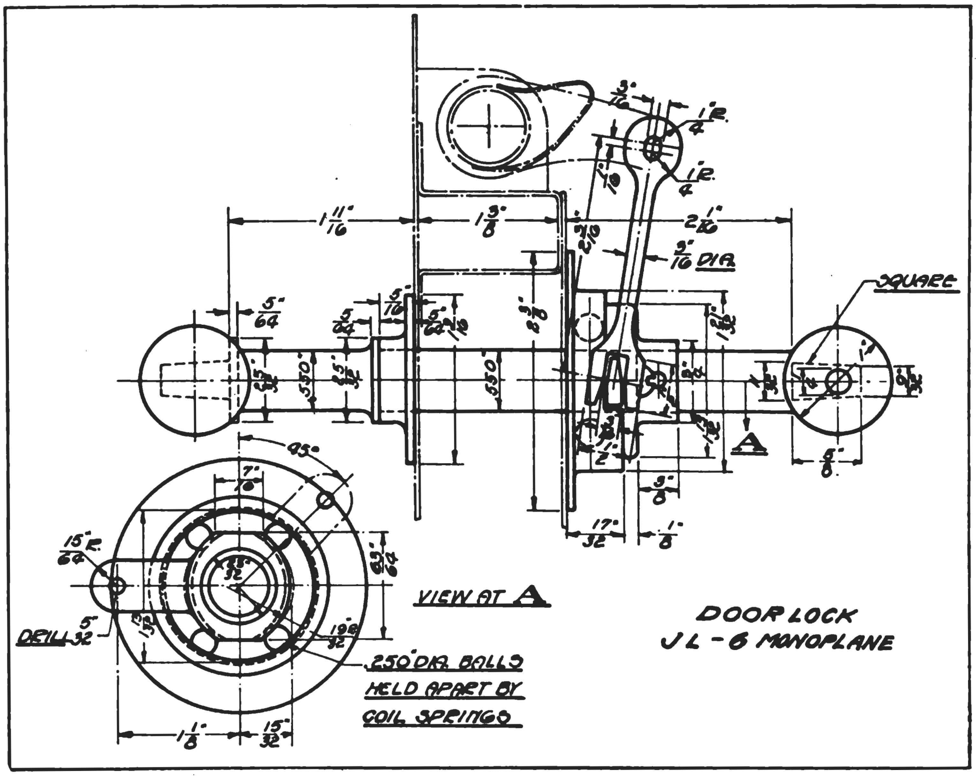

SQUARE
VIEW AT A
DOOR LOCK
J L - 6 MONOPLANE
.250" DIA. BALLS
HELD APART BY
COIL SPRINGS

Fig. 53.

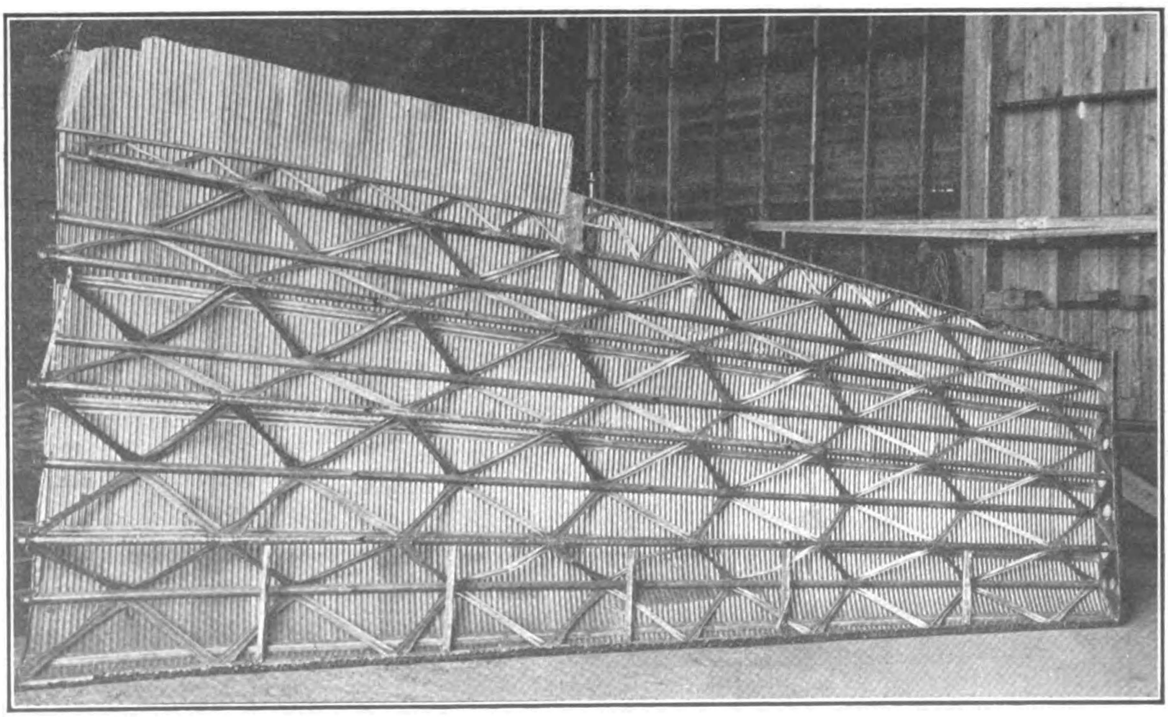


Fig. 54.

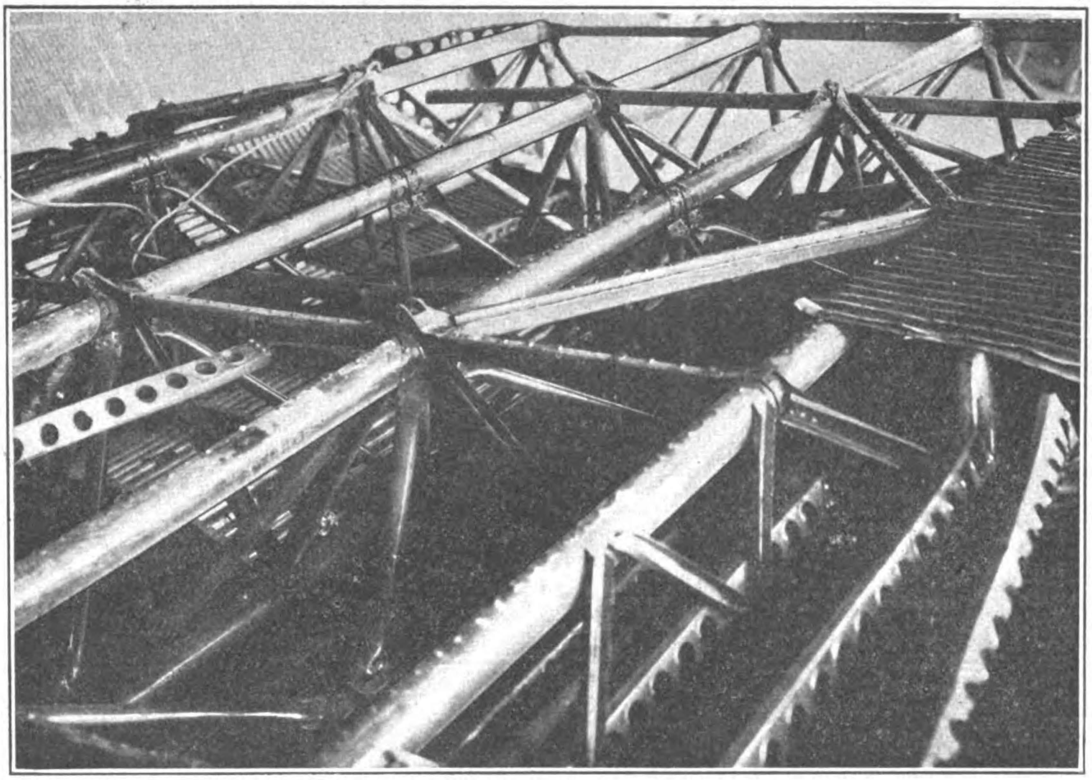


FIG. 55.

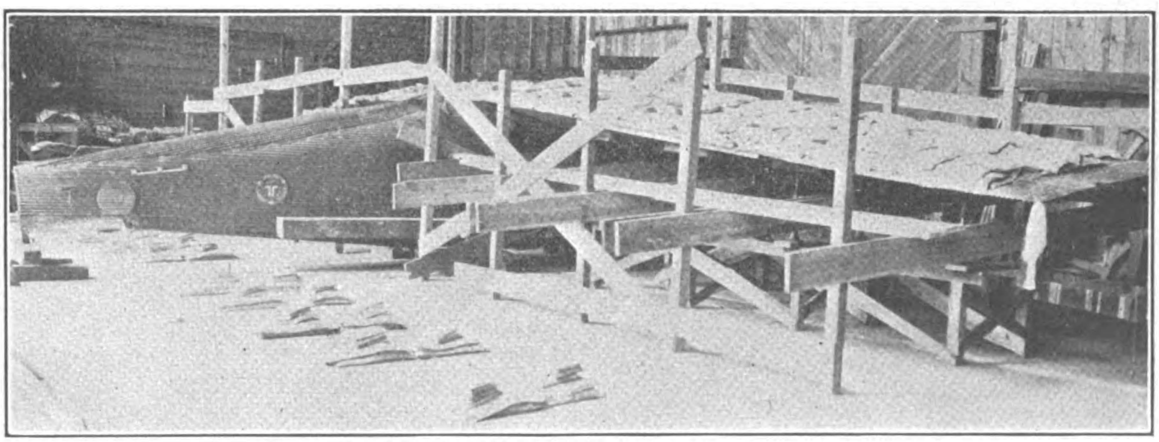


FIG. 56.

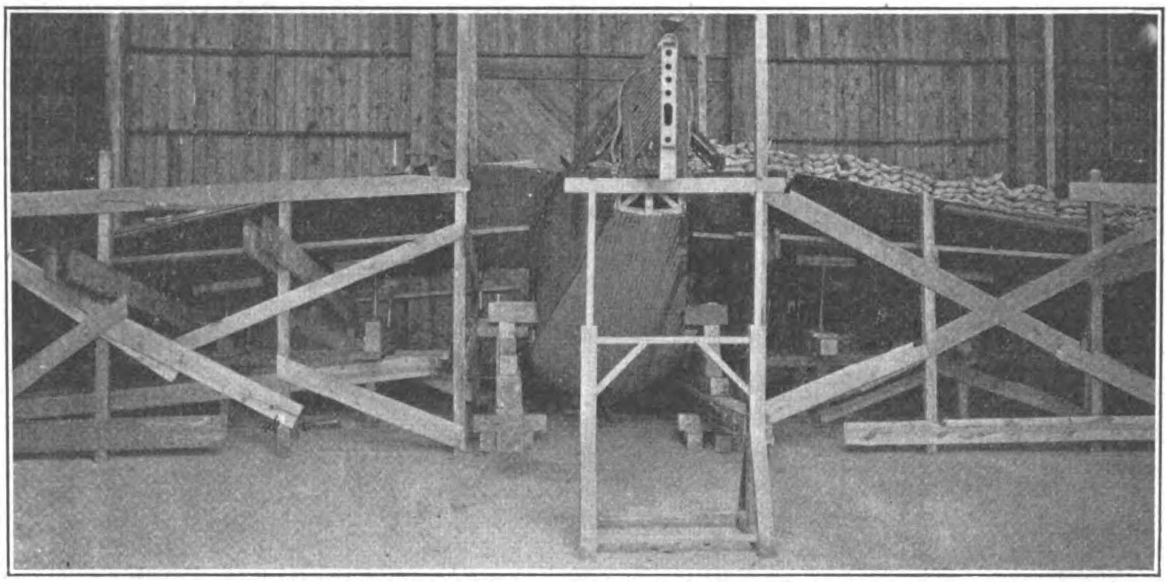


FIG. 57.

FIG. 58.

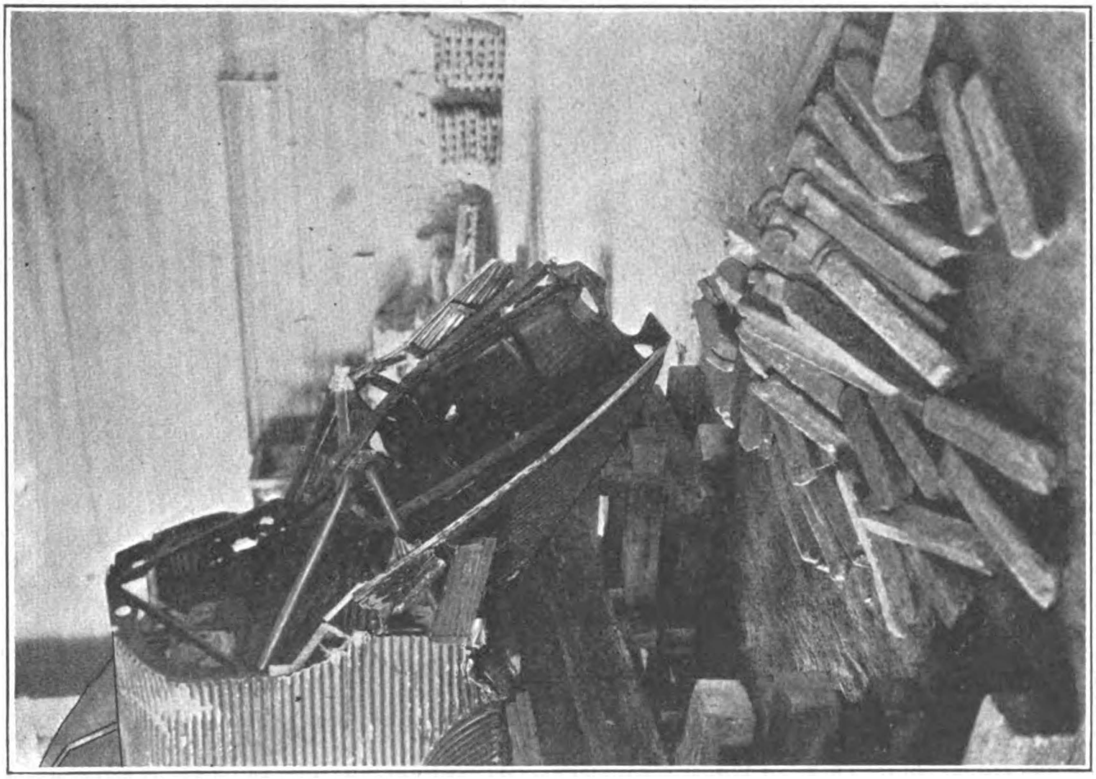


FIG. 59.

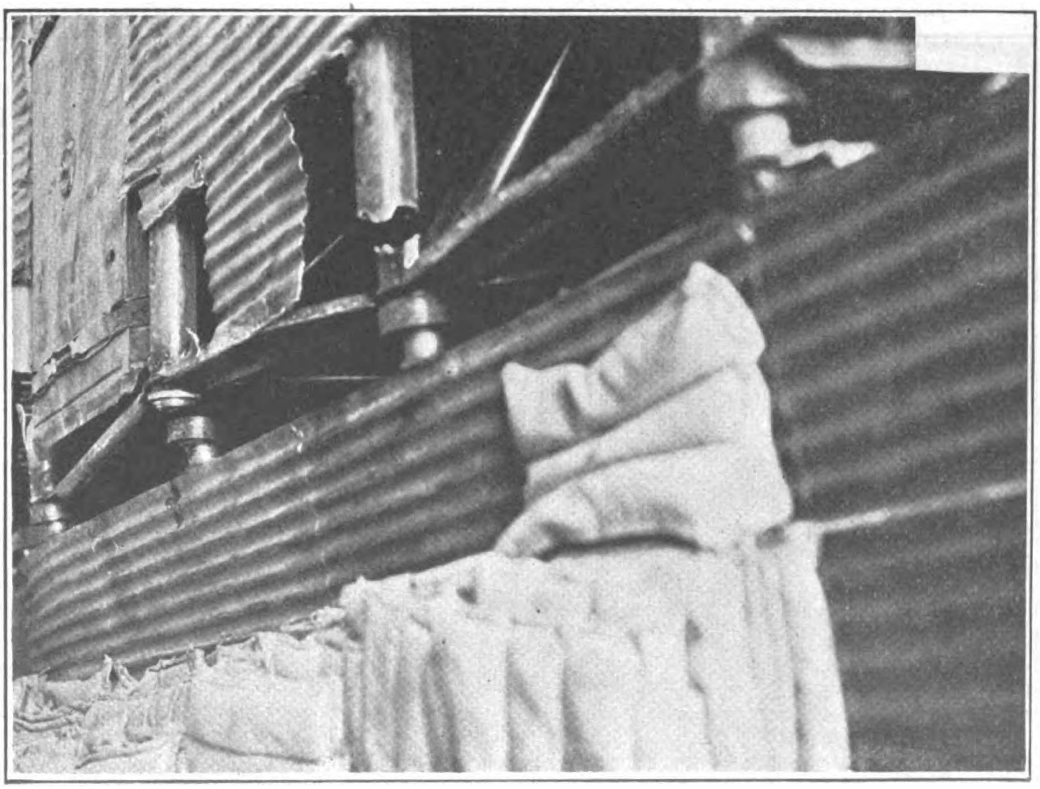


FIG. 60.

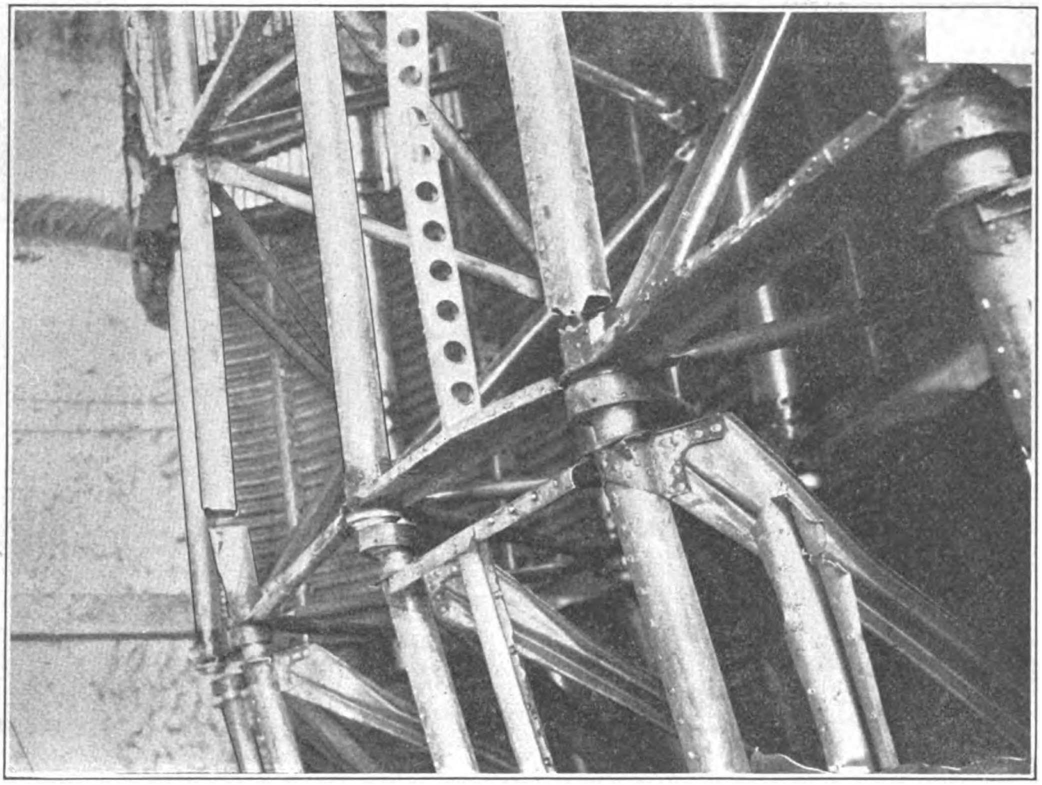


FIG. 61.

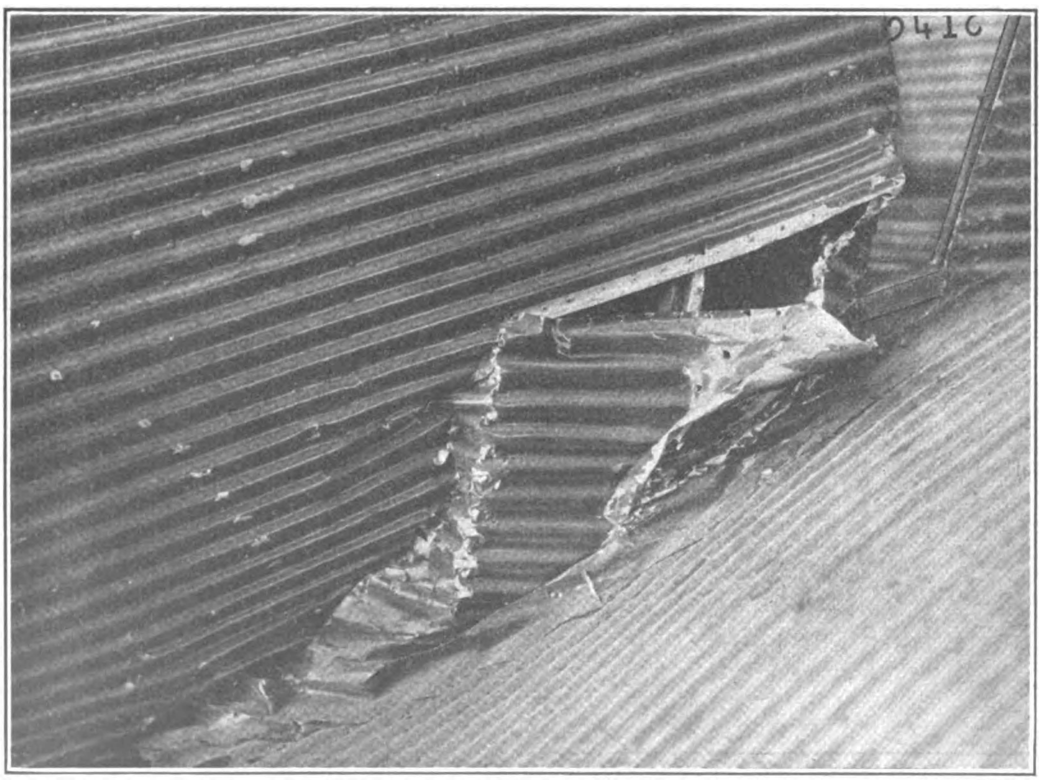


FIG. 62.

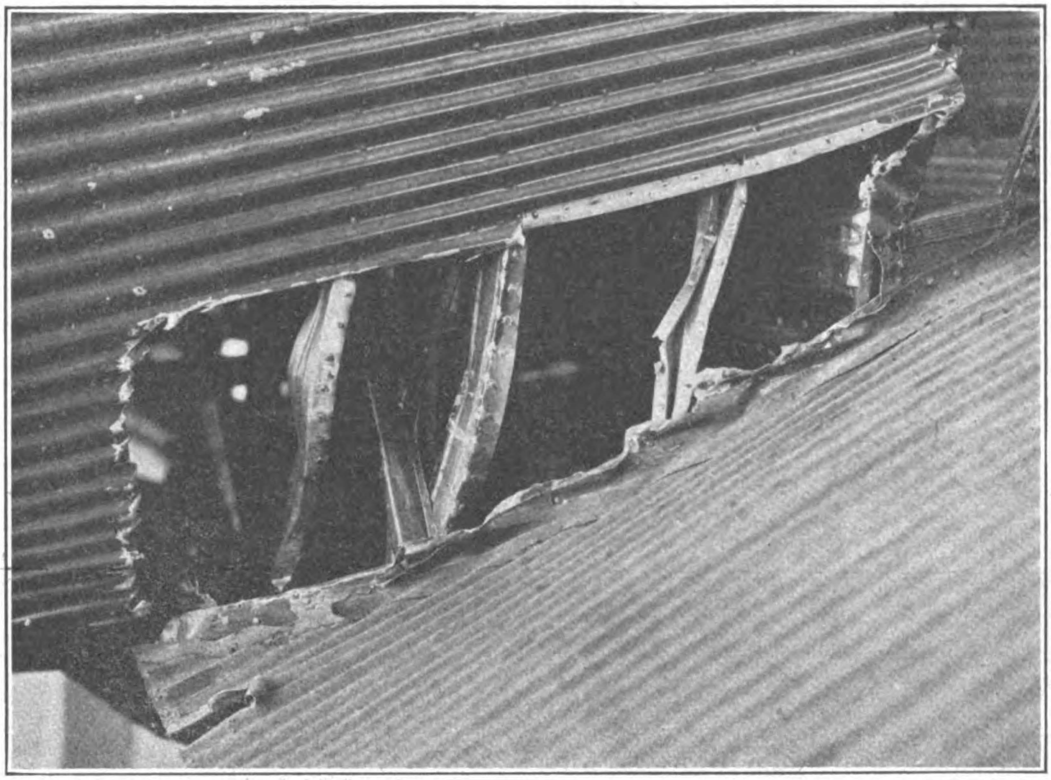


FIG. 63

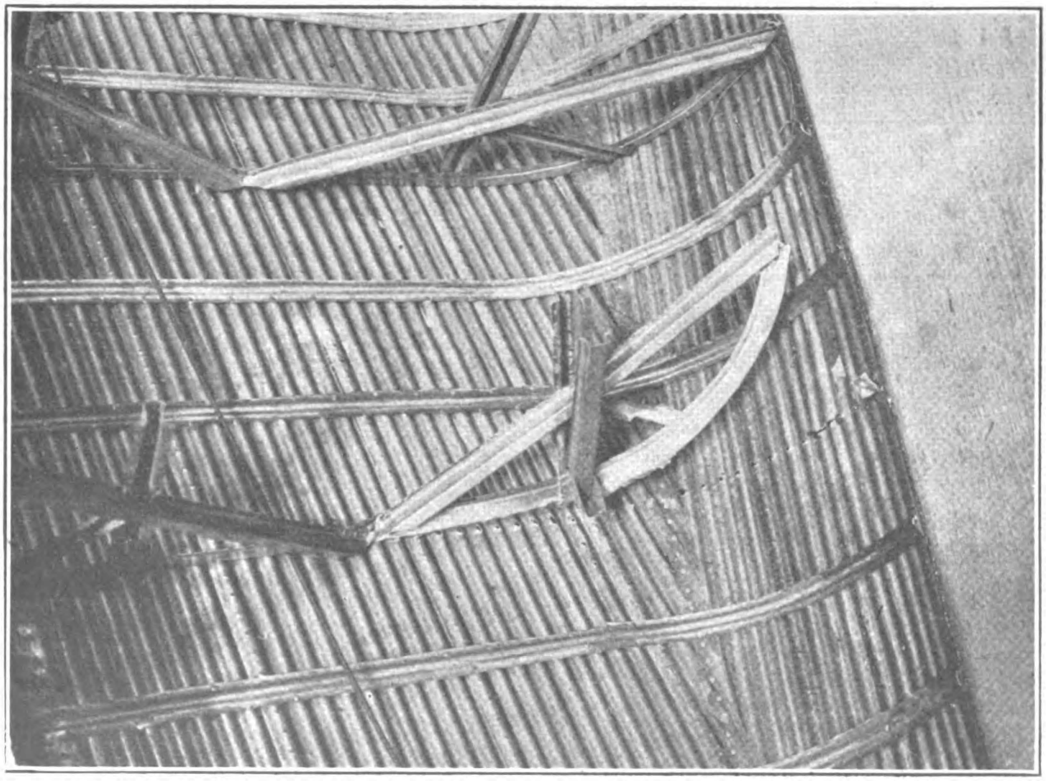


FIG. 64.

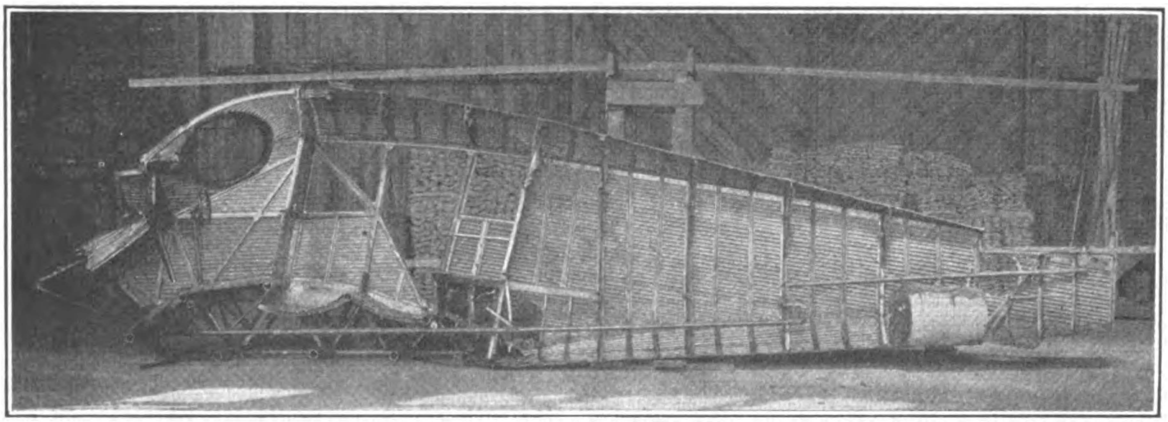


FIG. 65.

AIR SERVICE INFORMATION CIRCULAR

(AVIATION)

CHANGE No. 1

WAR DEPARTMENT, AIR SERVICE,
May 1, 1925.

Page 10, Figures 7 and 8, Air Service Information Circular, Volume IV, No. 360, "Report of Static Test of the Junker L-6 Monoplane," is corrected by direction of the Chief of Air Service, in accordance with a recommendation of the Engineering Division contained in letter of March 18, 1925, as follows:

Page 10, Figure 7, substitute the following:

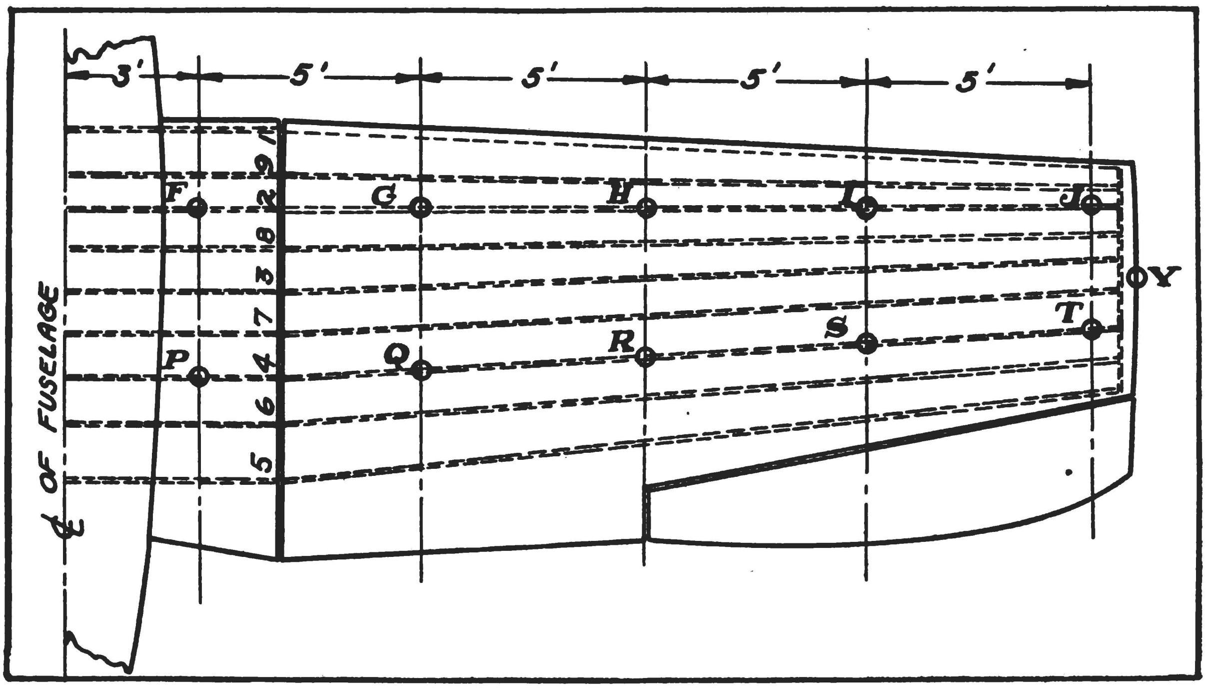


TABLE OF DEFLECTIONS OF RIGHT WING FOR HIGH INCIDENCE

Load factor	Deflections in inches at—										Retreat
	Front spar					Rear spar					
	F	G	H	I	J	P	Q	R	S	T	Point Y
2.0	0.6	1.1	2.0	2.9	4.1	0.3	0.9	1.8	2.9	4.1	+0.8
3.0	.8	1.7	3.1	4.5	6.4	.5	1.6	2.9	4.5	6.4	+1.0
3.5	.9	2.1	3.7	5.5	8.0	.6	1.9	3.5	5.5	7.8	+1.1
4.0	1.1	2.4	4.4	6.4	9.4	.8	2.3	4.1	6.6	9.3	+1.3
4.5	1.2	2.9	5.1	7.5	10.9	1.0	2.6	4.8	7.5	10.7	+1.5
5.0	1.2	3.2	5.8	8.5	12.3	1.2	2.9	5.5	8.4	12.2	+1.8
5.5	1.3	3.5	6.5	9.8	13.9	1.2	3.1	6.3	9.6	13.7	+2.0
6.0	Deflection readings discontinued.										
6.5											
7.0	Failure.										

FIG. 7

46868—25†

Page 10, Figure 8, substitute the following:

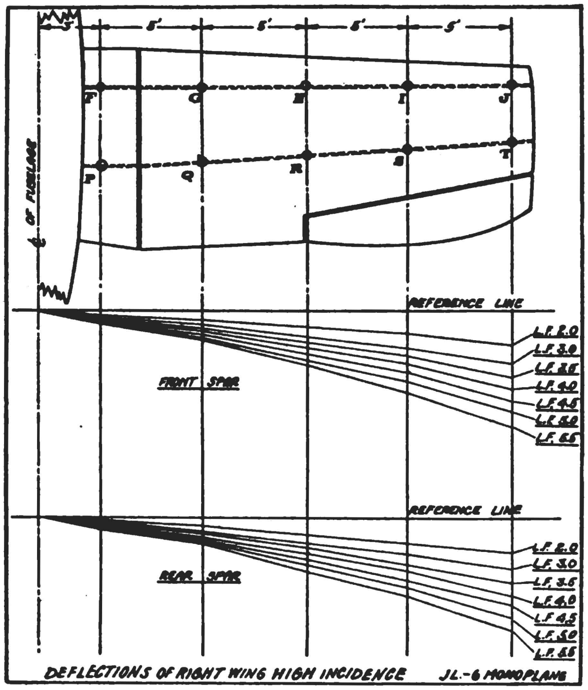


FIG. 8

(C. A. S. I. C. 1)

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